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ROYAL GEOGRAPHICAL SOCIETY.

CONDITIONS OF FELLOWSHIP, &c.

Candidates for admission into the Society must be proposed and seconded by Fellows, and it is necessary that the description and residence of such Candidates should be clearly stated on their Certificates.

It is provided by Chapter IV., § 1, of the Regulations, that—

"Every Ordinary Fellow shall, on his election, be required to pay £5 as his "admission fee, and £2 as his first annual subscription, or he may compound, "either at his entrance by one payment of £35, or at any subsequent period on the "following basis:—

Fellows of 20 years' standing and over	... ...	£12 10s.
" 15 " " and under 20	...	£16
" 10 " " " 15	...	£20

"And no Fellow shall be entitled to vote or to enjoy any other privilege of the "Society so long as he shall continue in arrear."

All Subscriptions are payable in advance, on the 1st of January in each year.

The privileges of a Fellow include admission (with one Friend) to all ordinary Meetings of the Society, and the use of the Library and Map-room. Each Fellow is also entitled to receive a copy of all the Society's periodical publications. The *Geographical Journal* is forwarded, free of expense, to all Fellows whose addresses are known.

Copies of the Year Book, Regulations, and Candidates' Certificates may be had on application at the Society's House, 1, Savile Row, London, W.

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Authors are alone responsible for their respective statements.

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the Elizabethan Commemoration, and of our other special meetings. It is a great advantage to the Society to have the services of such an accomplished geographer and such an indefatigable secretary as Dr. Keltie.

In the office, too, we have zealous workers. Mr. Evis, the chief clerk and accountant, has been in our service for close upon forty years, and has held his present post for twenty years. Always efficient, always ready, he has proved himself to be a valuable official, and in the whole course of my acquaintance with him I have never known him to make a difficulty. Anything that is ordered or suggested is at once done. Of the two clerks in the office, Mr. Reginald Suggate has been in our service for over forty years, and looks as active now as when he joined. Mr. Henry Simpson has been with us for a quarter of a century, and has conducted the important work connected with the lantern slides from the commencement. Inventive and intelligent, he has been most useful as a photographic artist, apart from his clerical work. Mr. Simpson is now engaged in preparing the Antarctic photographs for the two Societies, and for the use of geologists and naturalists.

The next section of the work of the Society is, II. The *maintenance of the library and map-room.* Under a succession of such able librarians as Mr. Rye, Mr. Keltie, Dr. Mill, and Mr. Heawood, during the last thirty years, the library has steadily advanced both in the number and value of the books and in their arrangement. I believe now that it is the largest and best geographical library in the world. I remember that I began the first catalogue with the help of a boy named Tattersball in 1862, and it was completed by Mr. Purrier in 1866. Now there is a complete authors catalogue kept up to date, as well as an elaborate subjects catalogue. So that, if any Fellow of the Society wishes to study a particular region, the whole of its literature can be placed before him in a few minutes. The Society is well served by Mr. Heawood, a librarian who carefully trained himself to the work, and who is also an accomplished geographer, a man of literary attainments, and a most obliging helper to all who seek information from him. His assistant, Mr. Vincent Hawkins, has been with us for over thirty years, and has an intimate knowledge of our library; and two young lads, Arthur Jones and Woodrow, while working hard and diligently, are being trained to be future librarians.

In connection with the library I must mention the Hakluyt Society, for the editing of old voyages and travels which would otherwise be inaccessible. A thorough geographer, such as Lord Curzon of Kedleston, when about to explore a selected tract of country, makes himself acquainted with all that has previously been done in the same region; so that the study of volumes issued by the Hakluyt Society becomes a necessity to him. Hence the work of the two Societies is very closely connected. Two of your Presidents, Sir Roderick Murchison and myself, have been Presidents of both Societies at the same time, and our aim was to create an interest among the Fellows of this Society in the labours of the Hakluyt Society. These efforts have lately been attended by a good measure of success, thanks to our very able secretary, Mr. Basil Soulsby.

The map-room, with its great collection of maps and photographs, has been much used during the past year. Under the superintendence of Mr. Reeves the work is admirably organized, while his assistant, Mr. Allen, attends to visitors, conducts the routine work, and meets every emergency with intelligence and efficiency. The number of visitors to the map-room during the year has been 3593, of whom 91 came specially to consult the Ordnance Survey maps. The younger assistant, Mr. Graham Mackay, zealously occupies his time in performing his map-room duties, and in qualifying himself to be a draughtsman. He prepared the maps for my translation of the voyages of Quiros, and did the work entirely to my satisfaction.

The arrangements for the execution of maps for various purposes connected with the work of the Society, under the superintendence of Mr. Reeves, are excellent. Our three draughtsmen, Mr. Addison, Mr. Batchelor, and Mr. Milne, of different degrees of merit, are all well trained and efficient.

I can conscientiously congratulate the Society on possessing an excellent permanent staff in all respects.

III. *The third section* of the Society's work relates to the *training of travellers.* It will be remembered that my resolution on January 27, 1880, establishing the system of instruction for travellers, led to the employment of Mr. Coles as instructor, to the construction of an observatory on the roof, and in 1886 to the addition of geology, botany, and photography to our course, which had previously been confined to practical astronomy and surveying. In 1897 my original scheme was adopted in its entirety, by the resolution to grant diplomas, and by the appointment of an examining committee. Since the retirement of Mr. Coles, his very able and accomplished successor, Mr. Reeves, has continued the work with increasing success. I hear on all sides of Mr. Reeve's ability as an instructor. Many pupils are unable to devote the full time required for a diploma, but all receive useful instruction, and the list of diploma recipients is a goodly list. In my opinion, the plan for the instruction of travellers is the most valuable work that is done by the Society. During the past year sixty-two pupils have received instruction from Mr. Reeves, and nine have obtained the Society's diploma.

In this place comes the geographical instruction given to the two training ships *Worcester* and *Conway*, because it is also under the superintendence of Mr. Reeves, who prepares the questions for the examinations, looks over the papers, and decides upon the recipients of the three prizes for each ship. I have paid very close attention to these examinations, and to their influence on the cadets, and I have no hesitation in saying that the results are increasingly satisfactory.

IV. The *fourth section* of the Society's work has reference to *assistance to travellers and to research.* For many years the Council has lent instruments and granted funds to travellers, and we have continued to do so; but our power to assist in this respect has been temporarily checked by the great sacrifices the Council has very properly made for the Antarctic Expedition.

In my address last year I explained that we had organized a Research Department as a development of the plan of considering scientific or technical papers at afternoon meetings, which was commenced in November, 1894. These afternoon meetings had been successful, and twenty-three good papers had been read and discussed from 1894 to 1903. They have been continued by the Research Department, but it was also thought that geographical research should be organized.

I have made several suggestions for this end, but none has been taken up. One proposal was the examination of the coast of Holderness and the Humber, and historical researches with a view to ascertaining the changes that have taken place on the coast and in the river since Roman times. Last October I read a paper to the East Riding Antiquarian Society at Hull, on the connection between archæology and geography. I visited the warping near Saltmarsh with Colonel Saltmarsh. I found that there were numbers of local antiquaries, geologists, and marine surveyors ready to communicate their information. A bibliography has also been made. But here the matter stops. There is no one to take up all these threads and prepare a complet memoir. Here I foresee a difficulty in the progress of the Researc Department, namely, the difficulty of finding trained men to undertak work. As geographical education progresses this difficulty may becom less, but at present it appears to me to be formidable.

The Research Department has also given attention to the bes methods of bringing out physical features on maps of various scales receiving assistance from Colonel Johnston, the Director of the Ordnan Survey. But there is a continual advance in map delineation, and would not be possible to establish a standard. Our cartograph watch and adopt improvements, or design them. The recent publi tions of Mr. Bartholomew attest his care and vigilance in produci his maps with all the newest improvements, combining accuracy w beauty of execution. Such work can only be brought out after ye of careful study and much research, and the results are highly cre able to our country. It is on such lines that all our cartograp should work. But the school of map-makers is now a small one. used to have as many as three cartographers on our Council.

there are only a few in this country besides Mr. Bartholomew, namely, Mr. Ravenstein, Mr. Bolton of Mr. Stanford's firm, Mr. Darbishire, Mr George Philip, and the younger Mr. Stanford at Oxford who has obtained the Oxford diploma.

Our allied societies of Edinburgh, Manchester, Liverpool, Tyneside, and Southampton have been established within the last twenty years. I delivered addresses, at the opening of their sessions in 1893, to the societies of Manchester, Liverpool, and Tyneside; and I delivered the opening address at the founding of the Southampton Society on November 16, 1897. Last year I had the pleasure of visiting the Scottish Geographical Society.

It seems very desirable that the British societies should work together with common aims, and there have been several meetings of delegates from all the societies to discuss the matter, but without results which can be considered satisfactory. Some have had dreams of an imperial central society with several closely affiliated branches, and one monthly publication in common. Other plans have been suggested. I think that this problem might usefully engage careful attention in the future, and that there might well be a satisfactory outcome of mature deliberations.

V. The *promotion of geographical education* is the *fifth section* of the Society's work. The principle I have always adhered to is, that it would certainly lead to a waste of money if aid was granted without any control over the way in which such grants were administered. My contention has been that a complete system of geographical instruction might be established with help from this Society, if a share of the control was retained by the Council. In consequence of a proposal of this kind, I was invited by Sir William Anson, the Vice-Chancellor, to meet a committee at Oxford, and on February 2, 1899, it was agreed that a sum of £800 a year should be provided, half by the University and half by the Society, to establish an Oxford School of Geography. There were to be three representatives of our Society on the committee. The University was to grant a diploma, and there was to be a scholarship of £60 a year. The old Ashmolean Museum was set aside for the school of geography, consisting of a lecture-room, a library and map-room for study, and an instrument-room. The resignation of Mr. Mackinder, which has just been announced, will necessitate a new arrangement, not yet complete. I remember being much struck by the great ability and insight shown in Mr. Mackinder's paper, entitled "The Objects and Scope of Geography," when it was referred to me on November 28, 1886. Since then he has won a name as a leading geographer. He has been eighteen years Reader in geography at Oxford, and has conducted the school of geography. He has served the University and our Society right well, and his lectures have been crowded. I wish him success in his new sphere of usefulness to geography at the London School of Economics, and at the London University.

I announced the arrangements that had been made at Cambridge for the establishment of a school of geography, with the help of our Council, in my last address. A board of geographical studies has been formed, on which there are three representatives of our Council, and another member who is on the Council, though representing the University. During the last year there have been several meetings of the Board, and there was evidence that the representatives of the University are seriously determined to make the teaching of geography a success. Lecturers have been appointed for the various branches of the subject.

There has recently been a correspondence in the *Times* on the subject of geographical education, which had the effect of showing us who were our friends, and who were lukewarm or inimical. We now have the Universities of Oxford and Cambridge actively on our side. There is a Board of Geographical Studies in the University of London, on which the Society is well represented; and the subject has been accorded a substantial place in the University examinations. The University of Edinburgh also contemplates the creation of a chair of geography, and our Council has subscribed towards the endowment. We have the War Office with us, which is a most important point; and the best military opinion, represented by the director of the Staff College, the son of our revered President, Sir Henry Rawlinson, is strongly in favour of the teaching of geography.

Progress is slow but sure. The other Government Departments will follow the lead of the War Office. The Universities will continue their work so well begun, and will eventually turn out properly trained teachers of geography in sufficient numbers. Then the schools will be obliged to give geography its proper place in their scheme of studies; and finally, the Civil Service Commissioners must succumb. I believe that the hardest and most difficult period of our advocacy is nearly past, and that continuous, steady pressure in the right directions will, before very long, have the effect of securing satisfactory results.

VI. Twelve years ago I pointed out that it was a fallacy to suppose that *the work of discovery* was nearly completed, and that there are no unknown regions, except the polar regions, to explore. It was a fallacy then, and, although much has been done since, it is still a fallacy. There are wide tracts, in all the great divisions of the Earth, which are unknown to us, and which will furnish work to explorers for many years to come. Moreover, there are regions of vast extent which are only very partially known to us, the more detailed examination of which will enable explorers to collect geographical information of the highest value and of the greatest interest. Our motto must still be "Ob terras reclusas."

In the address which I had the honour of delivering to my associates in November, 1893, I entered, in some detail, into an enumeration of the parts of the Asiatic continent which were then unknown and in need of exploration. During the twelve years that have since elapsed, many gallant explorers and surveyors have reduced the unknown areas considerably, and supplied us with much valuable information. In Asia Minor, where the Society has given so much help to explorers, we have since had papers on the headwaters of the Euphrates by Mr. York, on the cañons of the Euphrates by Mr. Huntington, on Caria by Mr. Myres, and an excellent memoir on the Cilician Gates and on the orography of the region by Prof. Ramsay, while Colonel Maunsell has contributed a valuable map, and Colonel Massy is about to give us the results of his recent work. In Arabia, Mr. Bent has given us the results of his journeys in Hadramaut and Oman.

Advances have also been made in our knowledge of Kurdistan and Persia. Colonel Maunsell gave us a most interesting paper on the mountainous region round the headwaters of the Bohtan and great Zab, tributaries of the Tigris; and Earl Percy has also traversed the Van region and the country of the Kurds. In Persia, Colonel Sawyer made us acquainted with Khuzistan; and Major Sykes with Kerman, Yezd, Bunder Abbas, and Seistan. We were impressed with the valuable work that is being done by Major Sykes in that region. Lord Rolandshay also brought to our notice an important route which he traversed in eastern Persia.

In the Afghan region we have had an important paper by Major McMahon on the southern border of Afghanistan, and others by Sir F. Younghusband on Chitral, and by Sir George Robertson on Kafiristan. Sir Thomas Holdich largely increased our information by his account of Tirah and the Afridis, and his paper on the geography of the northwest frontier of India. Sir Thomas has also pointed out, in another very interesting paper, the use of geography in the delimitation of frontiers.

The first geographical work of importance in Central Asia, during my presidency, was the settlement of the questions relating to the source of the Oxus by our Gold Medallist, Lord Curzon, the present Viceroy of India. Lord Curzon is one of those travellers who make themselves intimately acquainted with all that has been done before in the region they select for exploration. In this way alone can geographical work be done with any thoroughness. Dr. Sven Hedin has worked in the same way, and his labours have been considered to be of such exceptional value that our Council has awarded him the Victoria Medal for research, as well as the Royal Medal as a distinguished traveller.

Preceding and following Sven Hedin, our own travellers, Littledale, Wellby, and Deasy, all trained observers, have added largely to our knowledge of Central Asia, including the northern part of Tibet;

and we have received an excellent description of Bokhara from Mr. Rickmers.

Dr. Stein's journey to the region of Khotan, where he examined some of the abandoned cities, was of special interest and value, because he combined the qualifications of a linguist and archæologist with those of a surveyor.

By far the most important additions to our knowledge of Asiatic geography have been made in Tibet. This is a subject to which I have given close attention for many years. In the introduction to my work on missions to Tibet, I gave a detailed account of our political and geographical intercourse with Tibet, including the journeys of the pundits. It is pleasant to hear from Sir Francis Younghusband and Major Ryder that the work of these native explorers, undertaken under extraordinary difficulties, is remarkably accurate. Great credit is due to them, and also to General Walker and Colonel Montgomerie, who instructed and despatched them. In my book I made it clear that Warren Hastings had established most friendly relations with the lamas 130 years ago, and that if his wise policy had been made continuous that friendly intercourse would have been firmly established. There would have been a flourishing trade, and the lamas and governing classes would now be as friendly and enlightened as they were in the time of Warren Hastings. Their recent obstruction and present ignorance are solely due to their isolation. The people of Tibet have always been friendly, and the reception of Captain Rawling and Major Ryder, during their long journey, showed that the lamas are now also friendly. But I have not before mentioned the projected mission to Tibet of Mr. Colman Macaulay, which was abandoned in 1886. He had worked long to prepare for the mission, with energy and intelligence, and had visited Peking to pave the way. All was ready, when the Government of India suddenly abandoned the mission—a most unaccountable proceeding. Macaulay wrote, "Everything had gone so fairly that it was difficult to believe that we should be shipwrecked within sight of the promised land. However, we may still hope that something will be done, and that China will be kept to her promise to take measures to promote trade between India and Tibet." Vain hope! Poor Macaulay died, and the policy of drift was resumed. The unwise abandonment of Macaulay's mission was a calamity both for India and for Tibet.

It was due to the administrative wisdom of Lord Curzon that a mission to Tibet was at length organized on an adequate scale, and that our gold medallist, Colonel Sir Francis Younghusband, was appointed to conduct it. No better man could have been selected as the successor of Colman Macaulay, under a Viceroy who does not abandon what he undertakes. Younghusband had already won great distinction as a geographical explorer. He combines firmness and resolution with a conciliatory spirit when the time comes for it, so that he first beat down the opposition of the lamas, and then won their hearts. If the policy of Warren Hastings had been followed from the first, there would never have been any opposition. Trading stations have now been established at Gyantse and Gartok, which is a most important step in advance. But other excellent measures, such as the acquisition of the Chumbi valley for a long term of years, and the exploration of the Dihong gorge and of the Tengri-nor, were, unfortunately, prevented by military exigences and official prudence. Nevertheless geography has been a considerable gainer. Sir Francis Younghusband's mission, accompanied by two such surveyors as Major Ryder and Captain Cowie, has resulted in a survey of the Chumbi valley and of the whole route from Phari to the city of Lhasa, as well as a detailed plan of that city. Moreover, a party was detached by Sir Francis Younghusband, under Captain Rawling, with Captain Ryder as surveyor, to ascend the valley of Tsanpu from Gyantse to Gartok. Altogether, the triangulation of an area of 45,000 square miles has been completed, connecting Lhasa with India, all prominent peaks being fixed with their heights. An area of 17,000 miles was surveyed on a scale of 4 miles to the inch, route surveys of the road to Lhasa were made, and large-scale plans of Gyantse and Lhasa. On the march from Gyantse to Gartok, 40,000 square miles were surveyed, including the Tsang-po from Shigatse to its source, the Mansarowa lake region, and the Gartok branch of the Indus. For all this the chief credit is due to our Gold Medallist, Major Ryder. In my address for 1896, I drew special attention to the regions traversed by these officers, and to the importance of exploring the Tibetan continuation of the Karakorum range, which commences at the central peak of Kailas or Gangri, 21,800 feet above the sea. Mr. Brian Hodgson calls this Tibetan range Nyenchen-tangla. It rises from the northern bank of the Tsanpu, and Major Ryder has measured some of its peaks. He has much to tell us about this northern Himalayan range.

We have published, in our April number, an account of the excellent geographical work in Western Tibet done by Captain Rawling and Lieut. Hargreaves, to which I alluded in my address last year. The object of the expedition planned by these officers was the extension of Captain Deasy's survey made in 1896. They traversed a wild mountainous region with numerous lakes, and succeeded in surveying 35,000 square miles of previously unknown country—an exceedingly creditable achievement.

The results of the Tibet mission are of immense importance, both to that country and to India, from a commercial and a political point of view, and might have been still more important. To geography our gain has been very great, especially from the first regular survey of the upper Tsanpu valley.

Turning to the further East, we have had three valuable papers on Siam by Mr. Warington Smyth, another by Mr. J. S. Black, and a map, from careful surveys, by Mr. McCarthy. General Woodthorpe and Mr. Carey have given us information respecting the Shan States, Mr. Hugh Clifford on the States of Kelantan and Trengganu, and Prince Henri d'Orleans related to us the events of his adventurous journey from China to Assam.

In China some exceptionally valuable work has been done. The survey of Yunnan by Captain Davies, accompanied by Major, then Captain Ryder, will probably lead to the further development of that extensive province. The very interesting expeditions of Colonel Manifold in Central and Western China seem to supplement the work of Captain Davies; while, in describing the country round the headwaters of the Yang-tsze and its tributaries, they open up completely new ground. It is likely that the work of both Captain Davies and Colonel Manifold will lead to important results. Further north the results of many years' travel and survey in Manchuria by Mr. Turley should be mentioned, and Mr. C. W. Campbell's interesting journey through Mongolia.

Thus an immense advance has been made in our knowledge of the geography of Asia during the twelve years of my presidency, but much remains to be done. A vast area of Arabia is still unknown. The northern side of the Nyen-chen-tang-la remains to be explored and studied. No one has yet penetrated the Dihong gorge. There is a complicated area of mountain ranges and streams round the sources of the Burmese rivers which is entirely unknown. Many other parts of Asia are very incompletely surveyed and mapped, and need further study. There is still much, very much, for explorers to undertake on the Asiatic continent, and here assuredly it cannot truthfully be said that there are no longer unknown lands to discover.

My memories of African discovery go back to the time when the Dark Continent was nearly a blank. I knew Dr. Baikie of Niger fame. I remember Burton coming home with a wound in his mouth, got when poor Stroyan was killed. Speke came to me to discuss his plans before he went out with Burton. I was at the festival to Livingstone, and was much with him before he started on his last journey. But these are distant reminiscences. When I became President in 1893, I mentioned three regions in Africa that were unexplored, forty years having wrought a wonderful change. There was the Sahara and other parts of the French territory, there was Wadai and parts of the Lake Chad region, and there was the country south of Abyssinia and from Somaliland to the Sobat and the Nile.

As regards the Sahara, M. Foureau was even then engaged on his remarkable expeditions, not only penetrating further than any predecessor, but fixing his positions scientifically. For opening routes to the Chad region, geography is indebted to the energy and the administrative skill of Sir George Goldie in establishing order over the region of northern Nigeria, through which the routes pass to the eastward. We have had papers by Mr. Wallace, Sir Frederick Lugard, Colonel Vandeleur, and Major Burdon on northern Nigeria, and most valuable geographical information from Colonel Elliot, who was on the Anglo-French, and Colonel Jackson on the Anglo-German, boundary commissions. Our French colleague, Captain Lenfant, has, however, done the most important work in the Lake Chad region; while other French officers have done much new work to the west of the lake, and on the upper and middle Niger and the great bend of that river.

Colonel Trotter, in the course of his labours in the delimitation of the Sierra Leone boundary, collected much geographical information, especially on the source of the Niger, which he communicated to the Society.

Turning to the eastern side of Africa, the Ruwenzori country has been explored and described by Mr. Scott Elliot, Sir Harry Johnston, and Mr. Moore, and in part by Mr. Grogan in his journey from the Cape to Cairo. There have been two ascents of Mount Kenia: the first was by Dr. Gregory; the second I may describe as a model journey by Mr. Mackinder.

Uganda and British East Africa are becoming well known. After Sir Frederick Lugard, our lamented friend Colonel Vandeleur was one of the first to describe the country to us; and it has since been brought to our notice in more detail by Mr. Buckley, Captain Crawshay, Major Pringle, Mr. Hobley, Colonel Delmé-Radcliffe, Colonel Smith, Sir Harry Johnston, and Mr. Fisher; while the northern division has been described by Colonel Sir J. R. Macdonald and Major Powell Cotton.

Mr. Moore undertook a journey, which was full of interest, to Lake Tanganyika; and we have had papers on the Congo division by Mr. Grenfell, Mr. Hinde, and on the old kingdom of Congo by Mr. Lewis. Our most promising African traveller, and the one who has done the greatest amount of good work, is Major Gibbons, in his exploration of the Barotse country, and his journeys northward to Egypt.

The unknown country which I considered the most important in Africa when I addressed the Society in 1893, and which I still look upon as the most interesting, is the region south of Godjam and along the southern boundary of Abyssinia to Lake Rudolf, and from Somaliland to the Sobat and the Nile. Dr. Donaldson Smith, in his first journey, explored the Lake Rudolf region, and in his second admirably managed expedition he reached the Nile. Mr. Cavendish explored the shores of Lake Rudolf; and Major Austin, in his two very important expeditions, completed our knowledge of the country between the lake and the Nile, while Mr. Jesson has recently filled up important lacunæ.

The staff of surveyors under Colonel Talbot has executed a large amount of mapping in the Sudan, while Sir William Garstin and Major Lyons have contributed to our knowledge of the regions of the Nile. Other names connected with the exploration of Abyssinia are those of Mr. Crosby, Lord Lovat, Mr. Weld Blundell, and Mr. James Harrison.

North of Lake Rudolf there are some most interesting tracts of country near the southern frontiers of Abyssinia. A paper was communicated to us by Mr. Neumann, describing the upland countries of Kaffa and Enarea, on the southern slopes of the Abyssinian plateau; but much remains to be done in this the least-known part of Africa. The expedition under the auspices of Mr. Butter has since continued the survey along the southern frontier of Abyssinia, and we have received the results, with a valuable map from Captain Philip Maud.

A great deal of excellent geographical work has been done by the joint commissioners for the settlement of frontiers; by Colonel Leverson on the Anglo-Portuguese delimitation commission; by Captain Boileau on the Nyasa-Tanganyika plateau; by Colonel Elliot and Colonel Jackson in northern Nigeria, Colonel Trotter in Sierra Leone, and Mr. McCarthy in Liberia; and at a recent meeting Colonel Delmé-Radcliffe has given us an account of his work with the Germans to the west of Victoria Nyanza.

In the Lake Nyasa region, and the country between that lake and Tanganyika, much valuable work has been done by Sir Alfred Sharp, Mr. Codrington, Mr. Wallis, Mr. Beringer, and others, while Mr. Poulett Weatherley has added largely to our knowledge of Lake Bangweolo and the region to the westward.

Mr. Harris gave us a very interesting narrative of his journey across one pass of the Atlas, and of his visit to the oasis of Tafilet. But a great part of the Atlas mountains are still unexplored; nor should we forget the journey of our lamented friend Bent on the Red sea littoral, where also much remains to be done. Captain Crawshay's valuable contribution to our knowledge of Basutoland should be mentioned, and there are many other important journeys which have helped to fill up the blanks which disfigured our maps of Africa twelve years ago, but to which I have not space to refer in detail.

The progress of exploration in Africa during the last twelve years has certainly been very striking, and a large share of the credit belongs to our French associates, with whom our geographical rivalry has always been of a most friendly character. We shall next hear of them in Wadai. But whether in the Atlas mountains, on the Abyssinian frontiers, along part of the Red sea littoral, or in other regions, there remains much and important geographical work to be achieved in the African continent.

Probably the greatest extent of unknown land is in the New World.

In November, 1893, I quoted Mr. Dawson that 954,000 square miles were undiscovered. Since then there has been progress. Prof. Norman Collie's able researches in the Rocky mountains amount to discovery. Dr. Bell has informed us respecting the region south of Hudson bay, and young Mr. J. M. Bell sent us an interesting account of his work north of the Great Bear lake. Mr. Low's explorations of Labrador and to the south of Hudson bay are of high importance, while Mr. Hanbury and Mr. Tyrrell have traversed great stretches of barren lands of northern Canada. The most remarkable communication from North America has been Dr. Bell's account of his voyage along the south coast of Baffin island, and of the great inland lakes. It is so interesting because it shadows forth the geographical importance that attaches to further discoveries in this direction. I trust that they will eventually be undertaken by the Dominion Government, which has already done so much through the agency of its geological and topographical surveyors.

Respecting Mexico, we have had papers on the Sierra Madre and on Popocatepetl by Mr. Howorth, and a very excellent paper on the tribes of the Sierra Madre by Dr. Lumholtz.

There is no higher authority on South America than our Vice-President, Colonel Church, and in 1901 he gave us a most suggestive paper on South American geography. There are vast unknown areas, especially on the eastern side of Colombia, and any explorer would be sure to receive assistance from our Honorary Corresponding Member, General Don Rafael Reyes, the President of that Republic.

It is much to be desired that the whole structure of the Andes should receive systematic examination by young explorers sent out by the Research Department, who have won our diploma. We might divide the Andes, for this purpose, into four divisions. The first would be from the frontier of Ecuador (where the Andean peaks and ridges have been well examined by Humboldt, Wulf, and Whymper) to the knot of Cerro Pasco. Here are the great rivers Marañon and Huallaga. The work in each division should extend from the shores of the Pacific, across all the mountain ranges, to the banks of the first great river in the *montaña*. Mr Enock, a young mining engineer, has given us a lucid and fascinating description of one of the most remarkable features of this division of the Andes, namely, the lateral valley of Huaylas, with its bordering mountains, and an account of an ascent of one of the snowy peaks.

The next division extends from the knot of Cerro Pasco to the knot of Vilcañota, a region drained by the Apurimac and Vilcamayu, affluents of the Ucayali. The centre of interest in this division is the city of Cuzco, and much good work has been done in the *montaña* to the eastward, quite recently, by Villalta and other Peruvian explorers. The maritime cordillera, in this division, has never been systematically described to us; and the provinces of Parinacochas with its lake, of Lucanas, Cangallo, Aymaraes, and Cotabamba await examination by a competent geographer.

The basin of Titicaca would be the third division, and it is perhaps better known than the others. D'Orbigny and Forbes, Castelnau and Wiener, Minchin and Crequi-Montfort have studied the country and people. There are steamers on Lake Titicaca, but the more northern lake of Arapa is unexplored.* Our Gold Medallist Sir Martin Conway has done admirable mountaineering and surveying work on the mountains of Illimani and Illampu, but many peaks on this part of the maritime cordillera are unmeasured. Great credit is due to the Bolivians themselves for their recent exploring expeditions on the tributaries of the Beni, encouraged by our colleague Colonel Ballivian, and under the auspices and leadership of the late President of the Republic, Colonel Pando.

The fourth division would extend from the southern extremity of the Titicaca basin to the Andes of Chile. This includes a very wild mountainous region where the separate cordilleras unite into one. The Santa Catalina sierra, so graphically described to us by Mr. O'Driscoll a year ago, forms part of this division.

The Chilian Andes are much better known. Aconcagua, the highest mountain in South America that has been measured, has been ascended by one of Fitzgerald's party and by Sir Martin Conway. But further south, especially on the eastern side of the Patagonian Andes, I pointed out in my address of November, 1893, that we had a good deal to learn. Steffen afterwards gave us a paper on the Pacific side of the mountains, we had reports from Ramon Lista on the east side, and later our learned colleague, Don Francisco Moreno, gave us much information respecting the newly discovered lakes at the base of the Patagonian Andes.

It was the appointment of our Vice-President, Sir Thomas Holdich, on the arbitration commission, which led to our obtaining a more complete insight into the true character of this most interesting mountain system.

I first had the pleasure of making the acquaintance of Sir Thomas Holdich on the banks of Lake Ashangi, in Abyssinia, on April 28, 1868. He was then commencing a very distinguished career. Holdich has carried on surveys in the midst of warlike operations, and has conducted, with skill and success, the work of frontier delimitation on the Pamir. No one could have been selected who was so well fitted for the very responsible and laborious duty of settling the boundary between Chile and Argentina. He was quite new to the country and to the people, yet he acquired the confidence of both sides in the dispute. Through the papers he communicated to us, and through his book, we now have a fair knowledge of a very remarkable region, of special

* 'Castelman,' 3, ch. xxxix. p. 420.

geographical interest, which, in November, 1893, when I delivered my first address, was only very partially known.

The expedition of Dr. Nordenskiöld in the South Shetland islands and along the north-west coast of Graham Land, has resulted in the exceedingly important discovery of a fossil flora belonging to two geological periods, the Jurassic and the Tertiary. The discovery points to the existence of coasts covered with the vegetation of a temperate climate, at a distance of about 400 miles south of Cape Horn. One cannot help speculating on the outcome of such a discovery, though at present it is perhaps rash and premature to do so. But here appears to have been the continuation of the Andes, and the connection between South America and the Antarctic continental lands, at a time when the climate was mild, and vegetable and animal life were abundant.

Much has been done for the further exploration of Australia during my presidency, and also in Polynesia. But I only have space to refer to the important journey of Mr. Carnegie in West Australia, and to Prof. Gregory's investigation of the geography of the Lake Eyre region. In New Zealand we have derived much information from Mr. Fitzgerald's work in the Alpine region, and from the careful study of the lake country by Mr. Lucas. The appointment of my young friend, Mr. Mackintosh Bell, to the directorship of the Geological Survey in New Zealand is sure to lead to the best results.

The Society had done much towards the exploration of the Arctic Regions during the earlier years of its existence, while the despatch of the Arctic Expedition of 1875 was entirely due to its exertions. Our great object was to send an expedition up Smith sound, and explore the north coasts of Greenland and Ellesmere island. General scientific results, and the exploration of the unknown region, and not a sledging attempt to reach the pole, should have been, in our view, the main objects of the expedition. But the Admiralty announced that to reach the pole was to be the main feature. Nevertheless, excellent work was done by sledging parties to the east and west of the northern opening of Smith sound, for a distance of 300 miles. A study of the tides proved the insularity of Greenland, but the great result of the expedition of 1875 was that it enabled us to connect all former work, and to see the existence of a tremendous line of ice-pressure from near Cape Barrow to the east coast of Greenland. The great Arctic ocean presses its ice-covered waters against its western side, where the sole opening of escape is along the Greenland east coast.

Combining this with all that had been observed in other parts of the Arctic Regions, I was able to arrive at some general conclusions. I embodied these conclusions in my report on the Arctic Expedition of 1875–76, which was printed in our *Proceedings*,* now twenty-eight years ago.

* Vol. 21, No. vi. p. 536 (Old Series), September, 1877.

I then pointed out that the next most interesting object of future research would be to ascertain the extent of the polar ocean, the western limit of which was represented by the heavy ice-pressure on the American side. I maintained that Franz Josef Land was part of the Spitsbergen group on the same comparatively shallow plateau, and that there was a deeper ocean to the north. I also maintained that the warm current, aided by the discharged volumes of water from the Siberian rivers, caused a movement round the polar area from left to right, and also across from the eastern to the western hemisphere. My deduction was that, by the sea north of Siberia, important discoveries would reward the future explorer who boldly advanced northward on this line. He would be in the rear of the ice-laden polar sea discovered by the expedition of 1875, and would thus complete the solution of the questions in physical geography connected with it.

This was just the view taken, many years afterwards, by Nansen, after having carefully studied the Arctic questions. He arrived at his conclusions quite independently, never having seen my report, and his plan was absolutely original. When he did read my report after his return, he gave prominence to the coincidences, in the most friendly manner, in the preface to the Norwegian edition of his work.

Unfortunately, I was abroad when Nansen came to England to explain his scheme, and I lost the opportunity of defending it against the adverse and erroneous criticisms with which it was met. But it was a great pleasure to me to preside at the Albert Hall on February 8, 1897, when Nansen received a right English welcome on his triumphant return from his great achievements. For Nansen had drawn back the veil which had concealed the Arctic mystery. We now know that the Arctic Regions consist of a deep polar ocean nearly surrounded by land, with a flow of Atlantic water inwards on the Siberian side, and outwards down the east coast of Greenland.

There ceased to be any geographical object in reaching the north pole if it is in a deep ocean, except for the sake of deep-sea soundings. Our Council, in all its records, has discarded the attainment of the highest possible northern latitude and the attempt to reach the pole as useful objects, by themselves. To reach the north pole would be a sporting thing to do. It is quite feasible, but it is not likely to prove of any geographical interest.

There were still several very important pieces of geographical work that remained to be achieved in the Arctic Regions after the return of Nansen. The first was the rounding of the northern point of Greenland, another was the completion of our knowledge of the Parry group by the Jones sound route, and the third is the discovery of the unknown parts of the east coast of Greenland.

Captain Sverdrup undertook the Jones sound route, and, helped by a very efficient staff, he completed his discoveries during four years.

These discoveries finish the work in that direction, and probably complete our knowledge of the Parry islands. Captain Sverdrup and his geologist, Mr. Skei, gave us an account of these discoveries on April 27, 1903, when he received the Royal Medal.

Our other Gold Medallist, Captain Peary, succeeded in rounding the most northern point of Greenland; and he gave us a very interesting account of his expedition on November 10, 1903.

The east coast of Greenland remains to be explored. The coast from Shannon island, in 75° 12′, to the northern extreme reached by Peary, a distance of nearly 500 miles, is entirely unknown. Yet it is, in some respects, a region of special interest. Here, if anywhere, a knowledge may be obtained of the very interesting migrations of Eskimo and large mammals from east to west. Clavering, in 1822, found twelve Eskimo on the coast between 74° and 75° N. But none have ever been seen since to the north of the settlement of Angmagssillek. Knowledge is also needed of the northern migrations of the musk-ox, reindeer, wolf, and fox. The numerous deep fjords should be explored, and the labours of the German expedition, of Nathorst, and of Amdrup require to be connected and completed.

In Herr L. Mylius Erichsen we have an explorer who is both capable and willing to undertake this great task. He has already been with the Eskimo between Cape York and Cape Alexander for ten months, has sledged across the island of Disco, has visited the inland ice in two places, and knows the whole west coast of Greenland. If he succeeds in raising the funds for the expedition he contemplates to explore the east coast of Greenland, I would wish him all possible success, for I look upon this exploration and discovery of East Greenland as the most important work that remains to be done in the Arctic Regions.

I must not omit to wish God speed to young Amundsen in his very small vessel the *Gjöa*. I had a short cruise with him in the *Gjöa* on October 2, 1902. She is only 60 tons, a little cutter-rigged fishing-boat about the size of the vessels of Hudson or Baffin. His object is a most useful one—to reach the north magnetic pole and take a series of observations extending over a considerable period. It is not impossible that he may make the north-west passage. Such a gallant attempt deserves success, and I hope my friend Amundsen may attain his heart's desire.

We had received the gratifying news of the complete success of our Antarctic Expedition before the last anniversary. Since then we have welcomed our gallant friends, I trust, in a suitable manner worthy of the great occasion. At Portsmouth there was real enthusiasm, and the mayor welcomed the explorers with splendid hospitality. We strove to do the same at the docks and when they arrived in London. Next there was a grand reception in the Albert Hall. A special gold medal was presented to Captain Scott, and silver medals to the officers and men. I was anxious that justice should be done to their scientific work, and that the Fellows of the Society should be made better acquainted with it. My plan was that the officers charged with the different branches of scientific work should read preliminary papers at afternoon meetings, and that Captain Scott should sum up the general scientific results at an evening meeting. They all consented cheerfully. On February 6 last, Lieut. Royds, R.N., read a paper on the meteorology, and Mr. Ferrar on the geology. On the 20th we had papers by Dr. Wilson, on the geographical distribution of Antarctic seals and birds; from Mr. Hodgson, on the invertebrate biological collections; and from Captain Colbeck, on the Antarctic sea ice. On May 16 Mr. Bernacchi addressed us on the magnetic and other physical observations.

On February 27 Captain Scott read his very important paper on the geographical results of the Antarctic Expedition. But we must wait for full and complete information until the publication of his book next autumn. The scientific results will take a longer time for their preparation. The geology and biology will form two or more volumes, brought out under the auspices of the British Museum, and edited by Prof. Ray Lankester. The meteorology is undertaken by the Meteorological Office in a series of memoirs, two of them by Lieut. Royds, R.N., and Mr. Ferrar. The magnetic and pendulum observations will be worked up at the Kew Observatory. The resulting volumes are to be of uniform size. Arrangements are also being made for the issue of the *South Polar Times* in facsimile, the only serial publication ever produced in the Antarctic Regions. It contains several articles on equipment, on natural history, geology, and magnetic work, which are of great value, besides humorous contributions and records of events, and is most beautifully illustrated. It brings home to us what life in the far south really was, and is an essential part of the history of the expedition.

Lieut. Mulock, R.N., has been working hard, for several months past, at the maps of the Antarctic Expedition, and he hopes to finish the work by next June. But Mulock does what he has to do thoroughly. He has worked over again every sight and every bearing, which takes time. The result will be a map of remarkable accuracy, most artistically drawn and finished, which will be of great value to geographers and geologists.

All has gone well except with the good ship *Discovery*. It was our earnest wish that so valuable a vessel—the only one ever built specially for scientific purposes—should be taken by our Admiralty, and preserved until she was needed for another expedition. We offered her at a price which would only have left us just sufficient funds for the publications. She would have been invaluable for magnetic observations, as she is the only vessel on board which they can be taken. I understand that the American Government is building a vessel specially for that purpose. The *Discovery* would also have been useful for deep-sea soundings, for surveying, and for other purposes. She is larger than any vessel now used for surveying. But the Admiralty was badly advised, and the refusal must be looked upon, under the circumstances, as a national calamity.

We were thus driven into selling the *Discovery* to the Hudson's Bay Company for £10,000. We have to thank our associate, Mr. David Bruce, who acted as our agent, for the efficient and liberal way in which he conducted our affairs at the docks, and in connection with the sale.

It will be a source of satisfaction to all who are interested in the expedition to know that Mr. W. E. Smith, C.B., our highly valued designer and adviser in building the *Discovery*, has placed the history of her construction on record in the *Transactions* of the Institution of Naval Architects. His paper, "On the Design of the Antarctic Exploring Vessel *Discovery*," was read at the special meeting of the Institution on April 12 last. It is accompanied by appendices on compass deviation, on the machinery, and on the specification, with several plans, and contains suggestions for improvements in the next ship for Antarctic work.

It only remains for me to record our most cordial thanks, and I am sure that all my associates will be in accord with me, to those who have brought this great expedition to a successful termination.

Our thanks are first due to the very liberal subscribers; for I think it a wonderful thing that upwards of £70,000 should have been raised for the two ships, *Discovery* and *Morning*. Above all, we have to thank Mr. Longstaff for his munificent and patriotic donation of £30,000. Such generosity takes us back to the days of Queen Elizabeth, when merchant princes, thoroughly understanding the needs of their country, came forward almost habitually to provide funds for expeditions of discovery. In later times, Sir Felix Booth did the same for the expedition of the Rosses, and was rewarded with a baronetcy. Mr. Longstaff's great service, he may feel assured, has the admiration of his countrymen.

Nor must our New Zealand friends be forgotten. Their kindness and hospitality was unbounded, while their Government generously subscribed £1000 towards the equipment of the *Morning*, when our own Government had refused all help.

Gratitude is also due to my valued colleagues, the members of the Joint Antarctic Finance Committee, and to their secretary, Mr. Cyril Longhurst. They have transacted the whole business of the expedition in this country during five years most harmoniously, and are as good friends now as they were when they began.

Our Council recorded a resolution in recognition of the great services of Captain Scott, his officers and men. I firmly believed that they had all the mental and physical gifts which command success. There are few men who combine so many qualifications as Captain Scott for the leadership of such an expedition. Those qualifications ensured good results, and, having acquired the full confidence of his officers and men, they were ready to do anything for him and to follow him anywhere. That is the explanation of the extraordinary success of the sledge journeys. The captain was the best man among them, fared exactly as the men did, and worked harder than any of them. His excellent system of organizing and directing the scientific work was no less to be commended than his care for the health and comfort of all under his charge. Every officer and every man was zealous for the interests of the expedition, while perfect harmony and good fellowship reigned throughout the commission. Never did officers and men so worthily win and so fully deserve the thanks and approbation of the great Societies they have served so well.

We have also to thank Captain Colbeck and the officers and men of the *Morning*, who so loyally supported him. A better man than Captain Colbeck for such work could not have been found. His two voyages were conducted with rare ability, and he was ready to give his last bit of coal to the *Discovery*. The Council has endeavoured to mark their sense of the value of his services by the presentation of a piece of plate emblematic of his Antarctic voyages and their object.

I do not now hesitate to declare that my chief object in working for the despatch of the Antarctic Expedition was to give young naval officers and men a chance to distinguish themselves in time of peace. From the days of Nelson there have been no better fighters than Arctic men. Polar service braces them up for the regular work of the navy. Our worthy petty officer, Edgar Evans, was the best sledge traveller next to Captain Scott, and now he is one of the best shots on board the *Narcissus*. There is no more useful service to the country than the encouragement of maritime enterprise, to which England owes her greatness and her colonies.

The next object, in which I was bound to take an interest, was geographical discovery and the advancement of the kindred sciences which are the handmaidens of geography. It is justifiable to look at Captain Scott's discoveries with reference to the still unknown Antarctic area, and to endeavour to form some idea of the unknown part based on our actual knowledge. For the discoveries of Captain Scott's expedition furnish indications which enable us to enlarge our conceptions of the real nature of the whole area, and to give reasons for opinions respecting the parts which are still unknown.

For convenience in describing the several parts of the vast region, it is divided into four quadrants—

I. The Victoria Quadrant, 90° E. to 180° E.
II. The Enderby Quadrant, 90° E. to the meridian of Greenwich.
III. The Ross Quadrant, 180° to 90° W.
IV. The Weddell Quadrant, 90° W. to the meridian of Greenwich.

It is curious that land has been reported on the Antarctic Circle from 170° E. to 97° E., along the curve of the Victoria Quadrant, and also along the curve of the Enderby Quadrant. Some of this land is doubtful, and some that has been reported has since been found to have no existence.

In 179° 55′ E. is the interesting island discovered by Captain Colbeck, and named Scott island. In 163° E. are the five Balleny islands, undoubtedly volcanic. The distance thence to Adelie Land is 430 miles.

On January 16, 1840, Captain Wilkes thought he saw land in 157° 46′ E., and on the 18th in 154° 30′ E., and again on the 22nd. But in February, 1850, the *Brisk*, a ship belonging to the Southern Whaling Company, under the command of Captain Tapsell, started from Auckland island, and sailed as far as 143° E., considerably to the south of Wilkes's track, and there was no land. Again, on March 3, 4, and 5, 1904, Captain Scott, in the *Discovery*, sailed across the meridians from 175° to 154° E., to the south of Wilkes's track, in very clear weather, and saw no land. The soundings gave a depth of 250 fathoms.

From January 19 to 30 Dumont d'Urville, in 1840, saw land from 140° E. to 130° on the Antarctic Circle, but it was only made out at a great distance, with icebergs intervening. A landing was effected on one of eight or ten rocky islets. He then sailed along ice cliffs further north for 60 miles, from 137° to 134° E. The distant land was named *Adelie*, and the ice-cliffs *Côte Clarie*. Wilkes appears to have sighted *Adelie* and *Côte Clarie*, previously discovered by Dumont d'Urville, between January 30 and February 7, 1840.

On March 2 and 3, 1839, Captain Balleny had discovered land in 117° 4′ E., about 70 miles north of the Antarctic Circle. He named it Sabrina Land. Wilkes saw it indistinctly on February 10, 1840.

Captain Wilkes reported appearance of land at a great distance, from 112° to 106° E., and on February 14, 1840, he was only 7 or 8 miles from it. He described it as coast-line extending for 75 miles, and named it Knox Land. On February 17 he reported "appearance of land" trending north, when he was in 97° 37′ E. and 64° N. He named it "Termination Land." There cannot be any certainty about sighting Antarctic land at a distance, unless the complete outline is made out, or black patches of rock are seen on the mountain-sides. Drygalski has since reported that Termination Land does not exist; and Wilkes only reported "appearance of land."

In 1902 Drygalski came upon land in 66° 20′ S., consisting of a conical mountain called Gaussberg, on which a landing was effected, and a line of ice-cliffs, the whole between 89° E. and 94° E., about 120 miles. It was named Wilhelm II. Land.

No land is reported, with any certainty, between Côte Clarie and Sabrina Land, between Sabrina and Knox Land, or between Knox and Wilhelm II. Land.

There are thus four masses of land along the Antarctic Circle between 145° and 89° E., a distance of 1344 miles. Some of these lands are not within the Antarctic regions.

Adelie and Côte Clarie	...	145° E. to 134° E., 264 miles.
Sabrina	...	117° E.
Knox	...	112° E. to 106° E., 144 „
Wilhelm II. ...	...	94° E. to 89° E., 120 „

These lands rest on a shallow plateau with soundings of 250 fathoms. There is a theory that they are connected. In that case they would form the north coast of Queen Victoria Land. But there is no evidence. On the contrary, beyond North cape, the most northern point of Victoria Land reached by Ross in 1841, the land was trending *south* of west. In that case Adelie, Sabrina, Knox, and Wilhelm II. are volcanic islands on the edge of the comparatively shallow plateau, from which the north coast of Queen Victoria Land also rises, at a distance of 200 or 300 miles south of Adelie. The point is of slight importance with regard to the main questions at issue. The northern side of the great mass of Queen Victoria Land rises from this plateau, whether there are islands in front of it or not.

There is also land on the Antarctic Circle, on the outer edge of the Enderby Quadrant. Enderby Land, discovered by Biscoe in February and March, 1831, is on the Antarctic Circle in 49° E. A line of ice-cliffs and black patches on distant mountains were reported, ending to the west in a point called Cape Ann. In 1833 land was reported a little further east and named Kemp Land, but we have no account of its discovery, and the longitudes are doubtful. Kemp Land and Enderby Land are probably the same.

The distance from Wilhelm II. to Kemp Land is about 500 miles. It was here that the *Challenger* crossed the Antarctic Circle in 1873. The longitude was 78° 22' E. The *Challenger* narrative informs us that in 66° 35' S. there was a clear horizon, and that there could have been no high land within 60 miles to the south. The absence of icebergs between 70° and 80° E. was so marked that, coupled with their absence on the same meridians in lower latitudes, the conclusion was arrived at that there could be no land for a considerable distance to the south between 70° and 80° E., and that a high latitude could be reached in that direction.

This argument in the *Challenger* narrative is not very conclusive. If it was, it would be an additional reason for thinking that the coast of Queen Victoria Land beyond North cape continues to trend south of west, and does not turn northwards to connect itself with Adelie.

These indications of land along the Antarctic Circle—Adelie, Sabrina, Knox, Wilhelm II., Kemp, and Enderby undoubtedly point to the approximate position of the northern coast of the great continental mass known as Queen Victoria Land. The ice-cliffs reported at Côte

Clarie, Wilhelm II., and Enderby appear to be of the same character as those described by Larsen and Nordenskiöld on the east coast of Graham Land, and by Scott in Lady Newnes bay and at Cape Gauss. They might give rise to the formation of icebergs, but not those of the largest size.

The discovery of the eastern side of Queen Victoria Land by Ross in 1841, and Scott in 1902–03–04, has proved that a mighty range of mountains extends along that coast from Cape North to 83° S., a distance of 750 miles, with peaks rising to 15,200 feet. These mountains cannot be supposed to terminate suddenly at the furthest point seen by Captain Scott in 83° S., where the heights of their peaks were by no means diminishing. They may extend for at least double the distance, which would be 84° S. on the other side of the pole, perhaps even further. Here, then, is the eastern, and on the other side of the pole the western, side of the great continental mass of Queen Victoria Land.

The Victoria chain of mountains consists of primitive rocks, sandstones, and great irruptions of basalt. The sandstone is a formation of great thickness, and contains fossil plants. The strata are approximately horizontal, and there is no evidence that lateral pressure of the Alpine type has affected the region since the sandstone was laid down. Long after the deposit of the sandstone the volcanic streams appear to have forced their way through it and over it, forming basaltic caps. The undisturbed sandstone, capped by basalt, appears to extend from Mount Melbourne in 73° S. to the furthest southern point seen in 84° S.

Everywhere signs were noted of the recession, never of the advance of ice, whether in the glaciers, on the upper ice-field, or along the edge of the barrier. In Greenland icebergs come from discharging glaciers descending from the ice-cap. In the Antarctic lands such glaciers do not originate icebergs.

It was believed that the masses of ice attached to the land in several places were the remains of much more extensive glaciation at some distant time.

Near the coast in 79° S. there are several remarkable volcanic islands, on the largest of which is the still active volcano of Mount Erebus. Beside it is the apparently extinct volcano of Mount Terror, and there are three other volcanic islands, while on the mainland, the lofty peak named Mount Discovery, is another extinct volcano.

The mountain chain supports a vast ice-sheet, extending westward for hundreds of miles, and maintaining a level of nearly 9000 feet. At intervals immense glacial streams flow down openings in the chain, but most of them are now inert or receding.

The marvellous ice-cliffs discovered by Ross in 1841 are receding. They are 30 miles to the south of the latitude in which Ross saw them. This is one source of the great Antarctic icebergs. Resting on the island now named Ross island, which is formed by Mounts Erebus and Terror, in about 78° S., these ice-cliffs extend eastward for 400 miles. They form the termination of a remarkable ice-sheet, which is known as the Great Ice Barrier. Possibly it may fill up a rift or depression between two land masses. Resting on one side against the bases of the Victorian chain of mountains, it is partly fed by the glaciers descending from the inland ice-cap. The whole mass is believed to be afloat. This was indicated by numerous hypsometrical observations, proving that its surface remained only the thickness of the ice above the sea-level, and by the highest temperature in a crevasse being furthest from the surface, as well as by the appearance of tidal cracks.

Captain Scott discovered a continental mass of mountainous land to the eastward of the barrier, which he named King Edward VII. Land. Its coast trended north of east. The eastern side of the Great Barrier seems to rest on the western face of this newly discovered land. The barrier would thus be fed by the glacial streams from both sides.

The great barrier is perhaps the most extraordinary geographical phenomenon on this earth. The whole of the line of cliffs has been thoroughly examined, heights and soundings having been taken at frequent intervals. Captain Scott has himself explored it for 300 miles to the south, Lieut. Royds for over 150 miles to the south-east. But there was a clear horizon to the south, and its history is still a mystery. The most remarkable thing connected with it is that moist southerly winds blow over it with great force, with heavy falls of snow, raising the temperature several degrees, at the *Discovery's* winter quarters.

One theory, with respect to the Great Barrier, is that it merely fills a gulf of vast extent surrounded by mountains. This theory requires that the Victorian mountains should turn to the eastward, and curve round to unite with the mountains of King Edward VII. Land. But there is no indication that the mountains turn in that direction.

Another theory is that the Victorian mountains trend to the east and unite with Graham Land. The trend of the mountains, as far as could be seen, was S. by E. ½ E., which is in the direction of Graham Land. But it is not known whether Graham Land is an island or a long promontory. Nevertheless, this theory is very fascinating, and may possibly be the solution. It seems to connect the Andes, across the south pole, with the mountains of New Zealand. The Graham Land theory is favoured by Captain Scott, and is in agreement with the suggestions of Suess.

But no theory is quite satisfactory which does not include an attempt to explain the southerly winds causing a rise of the thermometer, and the south winds reported at the *Discovery's* winter quarters must be föhn winds, if either of these theories is correct. The barrier may have light thrown upon its history by the ascertained character of these south winds.

The föhn winds of the Alps and of the west coast of Greenland are dry winds, because they come from over mountains. A moist wind would come from a distant sea. On the west coast of Greenland the föhn winds are south-east winds coming from the Atlantic, where the Gulf Stream preserves a winter sea-temperature of 41° Fahr. Coming from the warmest part of the North Atlantic, and having the shortest distance to pass over the lofty ice-deserts of the interior of Greenland, the föhn increases its temperature in descending to the west, and comes down to Upernavik with a temperature of 42° to 50° Fahr. This föhn wind starts from the Atlantic at 41° Fahr., crosses 400 miles of Greenland ice-cap at heights of 6000 to 7000 feet, and then descends to the west coast. An Alpine föhn is calculated to lose $\frac{1}{2}$° Fahr. for every 180 feet that it rises on the south side of the Alps, and to gain $\frac{1}{2}$° Fahr. for every 180 feet that it falls on the north side, where it descends as a warm and dry wind.

The warm and snow-laden winds from the south experienced at the winter quarters of the *Discovery* are not, therefore, analogous to the Alpine or Greenland *dry* föhn winds. They are reported to be damp, laden with snow, and, if this is so, they have not passed over mountains. They were oftener from the south-west than from the south, but this is accounted for by deflection caused by the coast-line. Winds from the lofty inland ice-cap to the west come over in an upper current, as was shown by the direction of smoke from Mount Erebus, and do not descend to the surface.

We must, therefore, seek for the cause of the high temperature of these southerly winds from some other cause, and not from the winds being föhn winds. The north winds, which were very rare, were comparatively warm, because they came from the ocean to the north. The south winds may be warm from the same cause. They may blow from the ocean beyond the pole—that is, from the Weddell sea. The Great Barrier may, therefore, end on the other side of the pole with another line of ice-cliffs facing the Weddell sea. It fills up a comparatively shallow rift between the Victorian and Edwardian ice-masses, whose ice-fields continually feed it through their glacial openings. It is also fed by the annual snowfalls. Its length may be 1000 to 1200 miles, possibly more. On the other hand, there may be low land intervening between the ice-barrier and the Weddell sea.

The passage of the winds over that distance of ice-barrier with great velocity would not lower their temperature. The experience of the *Alert* exemplifies this. The föhn wind, with a temperature of 46° Fahr., after descending to the sea-level on the west coast of Danish Greenland on November 25, was at the *Alert's* winter quarters on the 26th, a distance of 1300 miles over ice at sea-level, raising the temperature several degrees. The Antarctic south winds, starting at a high temperature from an open part of the Weddell sea, would blow along the whole length of the barrier and reach the *Discovery* in twenty-four hours, or less, both warm and snow-laden. These south winds seem to indicate that the other end of the barrier may be an ice-cliff facing the Weddell sea.

But a serious doubt is thrown upon this theory by Mr. Shaw. He suggests that the snow coming with the south winds may be carried along in a surface drift, and remarks that the wind, in intense cold, can hold very little moisture. On the other hand, observers on the spot are confident that heavy falls of snow came with the southerly winds, and they were warm, not cold, winds.

The very extensive flat-topped icebergs of the Antarctic seas are too large to come from land glaciers, or from ice-cliffs resting on land. They must be the product of the 400 miles of ice-cliff terminating the barrier on the side of the Ross sea and on the side of the Weddell sea.

Turning to the Ross Quadrant, we find that the northward trend of King Edward VII. Land points towards the neighbourhood of Captain Cook's farthest in 71° 20′ S. and 106° 54′ W. Captain Colbeck found the bergs and floe-ice coming from the south-east, and he concluded that there must be a coast-line in that direction. Cook, at his farthest south, saw ninety-seven icebergs within the pack, like a ridge of mountains, and he thought that land was behind the ice. In the near neighbourhood is the position assigned by the Russian Expedition of 1819 to Peter island. It was seen only at a very great distance. Onward from Cook's furthest, the line of the northern coast of King Edward VII. Land is indicated by the line of the submarine plateau discovered by the *Belgica* from 75° to 103° W., which is only 270 fathoms below the surface, with an abrupt descent on the north side to 800 fathoms. The north coast of King Edward VII. Land would run parallel to the line of the submarine plateau, and perhaps 100 miles or so to the south. The Edwardian coast would then turn south to join with the side facing the barrier.

The Antarctic area would thus consist of two continental land-masses of unequal size, Queen Victoria Land and King Edward VII. Land, separated by this marvellous barrier; and of two seas extending far to the south, the Ross sea and the Weddell sea.

The Weddell Quadrant appears to embrace a large expanse of ocean. Bruce found a tolerably even depth of 2000 fathoms. Weddell sailed as far south as 74° 15′ on the meridian of 34° 17′ W. without seeing any sign of land to the south.

The Weddell sea is bounded to the west by the eastern coast of Graham Land. This is a long narrow strip of high land commencing in 63° S. and extending across (57° to 65° W.) the Antarctic Circle as far as 69° 30′ S. (the Alexander Land of Bellingshausen). Here Arçtowski reported that it appeared to terminate, but this is still uncertain. Thoroughly Antarctic as regards its climate, Graham island appears to be more connected with the Andes than with the Antarctic system. It is, however, suggested that it is a promontory running north from one of the Antarctic land-masses. It may be so, but there is, at present, no evidence to support the theory, while Arçtowski's evidence points to its being an island.

On Graham Land there are examples of ice-masses resting on the coast, and extending for upwards of 60 miles along the land, with a width of 40 or 50 miles. Nordenskiöld came to the conclusion that the ice-mass he examined rests on the land, but in part covers a shallow sea, and that it has been, for the most part, formed *in situ*. He calls it "the great ice-terrace," which is a better name than "ice-foot." The Arctic "ice-foot" is quite different. The Antarctic "ice-terrace" seems to be formed by successive layers of snow, and it partly rests on sea ice. The cliffs facing the sea are of varying height. When they are examined, it will probably be found that the "inland ice" of Drygalski, the ice-cliffs of Enderby Land, Côte Clarie, and cliffs to the west of Cape North, are similar "ice-terraces" peculiar to the Antarctic Regions; as well as the ice-masses of Lady Newnes bay, and the so-called Cape Gauss. Captain Scott considers that the latter formations are remains of more extensive ancient glaciation.

The land reported by Bruce in the Weddell sea, and indicated by his soundings, is much further to the west than was to be expected if it is continental land. It may be a large island.

Guided by our actual knowledge, it seems to me that the next Antarctic Expedition should work its way down the western coast of Graham Land, in the track of Larsen, and solve the question of its insularity. Whether Graham Land is insular or continental, the expedition should then force its way through the pack and seek winter quarters on the opposite side of the pole to MacMurdo sound. From that position a system of sledge travelling may be expected to throw much further light on geographical problems the solutions of which are indicated by the researches of the recent expedition. Sad experience has taught us that the despatch of such an expedition is the work of years. It may take less time when the spread of geographical education has reached to those in whose hands the decision of such matters rests.

Turning from these fascinating Antarctic questions, I ought to refer very briefly to our efforts to give the Fellows the benefit of hearing scientific and general papers occasionally, as well as the usual communications of eminent travellers on particular regions. Prof. Lapworth has favoured us with a paper on Earth-folds, and Prof. Milne on movement of the Earth's crust and on earthquakes. Prof. Gregory gave us a suggestive paper on the plan of the Earth and its causes. From the Prince of Monaco we have had an admirable paper on oceanography, and

Sir John Murray on ranges of ocean temperatures. Sir John Murray's bathymetrical survey of the Scotch lochs deserves special mention. From Dr. Mill we have had the results of his researches, undertaken on behalf of the Society, on the English lakes, and of his special study of a selected area in Sussex. From Mr. Vaughan Cornish we have had communications on the formation of sand-dunes, on the formation of sea-beaches, and on ripple-marks and waves. Such papers are very instructive and suggestive. But the most important general paper that has been communicated to us is contained in Mr. Mackinder's masterly address "On the Geographical Pivot of History."

I think it very desirable that we should continue to invite the communication to us of papers of the above kind.

The time has now come to bid farewell to you as your President. Do not for a moment believe that my love for the Society and its work has waned, nor that my desire to serve the Fellows has become less ardent. This is far from being the case. My time and my best efforts have been yours during the last twelve years; and in passing I may note that during that period nearly 800 Fellows have been added to the Society. In the decade from 1880 to 1900 the addition to our numbers only amounted to 150. But recently I have been constantly prevented by illness from taking the chair at our meetings, and from transacting the ordinary business. I felt, therefore, that, in the interests of the Society, I ought to resign my place to a younger and abler successor. With many shortcomings, I have done my best to serve you well, and I wish to thank all the Fellows for their forbearance and invariable kindness.

THE ANGLO-GERMAN BOUNDARY EXPEDITION IN NIGERIA.*

By Colonel LOUIS JACKSON, R.E.

The task of the Yola Chad Boundary Commission was to survey and delimit the Anglo-German boundary from Yola to Lake Chad. For this purpose it was necessary to fix the latitude and longitude of Yola, and to carry it up by triangulation to the southern shore of the lake and to Kukawa.

Our work lay in Adamawa and Bornu. Of the latter and its people, although it lies in Nigeria, I think not so much is known in England as of the Fulani. Bornu is the remnant of a great Mohammedan empire, which in the thirteenth century extended across the Sudan from Khartum to Timbuctu. Kukawa, the historic capital near Lake Chad, was a centre of commerce and Mohammedan enlightenment for hundreds of years, until in 1893 it was destroyed by Rabeh. At the

* Read at the Royal Geographical Society, March 13, 1905. Map, p. 128.

beginning of the last century, when the Fulani empire arose, the sultanate of Bornu had shrunk to a mere fraction of its former extent. Still, the people, although much degenerated, retained enough of their old military spirit to resist the Fulani invasion, and they kept their country, which extended roughly about 150 miles west and south of Kukawa, and eastward to the Shari river. Thus it happened that when we entered Nigeria we found that the predominant powers of the interior were two great Mohammedan nations, who, though at peace, were not on friendly terms. In 1893, just as we were trying to enter into friendly relations with the Bornu power, it was destroyed by Rabeh, a former follower of Zubeir Pacha, who had wandered and fought his way westward from Egypt. He established himself at Dikoa, and ruled with considerable success for some years, until he came into collision with the French, who sent a force from Fort Lamy on the Shari and destroyed him in his turn. After this a British force went up to occupy the country up to the limit which had been reserved to us by the arrangement with Germany in 1893; and shortly afterwards a German expedition came up from the Kameruns to occupy their country. The result of this was that Bornu was cut in two as Adamawa had been, with this difference—that the greater part of Bornu was British, while most of Adamawa became German. Both the British and German Governments proceeded to restore the old Bornu rulers, and Shehu Garbai, the direct heir to the throne, is now the Sultan of British Bornu, while his cousin, Shehu Sanda, is Sultan of German Bornu.

The Bornu people, like the Fulani, are horsemen, and probably owed their early successes to this. The Berebere, who were the seed of the Bornu nation, came from the north-west, from Barbary.

The origin of the Fulani is also assigned by some to Barbary; others have supposed that they came from Egypt. A reference to the map at p. 247 in Dr. Keltie's 'Partition of Africa' will show how the physical conditions of Africa govern racial movements. It will be observed that a great belt of bush and grass country runs right across Africa, roughly in lat. 5° to 15′ N. Movement to the south is checked by the Central African forest region, and to the north by the Sahara. It was thus natural that a pastoral people driven out from the Nile valley, perhaps, as some one has said, by the pressure of some earlier Mahdi, should have moved along this fertile belt until they found a resting-place; also that the Berebere should have drifted from the desert to a more fertile country. Rabeh's movement along the line of least resistance is also thus explained. It follows, again, that people accustomed to fight on horseback, moving in pasture country suitable for cavalry, would have a great advantage over the original Pagan owners of the soil, who probably had few horses. Thus it happens that throughout the Fulani country you find them paramount wherever the country is suitable for the movement of horses, while the unsubdued pagans have taken refuge in the hills or in the thick bush. Bornu country is suitable for horses almost throughout.

Comparing the people of the two countries in general terms, it may be said that those of Bornu are cheerful, indolent, fond of good food and clothes, and not very keen about their religion. They like military display, martial music, and waving of spears; but it is doubtful if there is much good fighting stuff among them. They are artistic, and display a good deal of taste in their somewhat gaudy clothes. The Fulani are inclined to be ascetic and fanatical. They wear a good deal of clothing, like other Mohammedans, but are not gaudy, affecting chiefly white, dark blue, or the grey-blue native cloth, with a certain amount of embroidery. They are not so clean as the others. When a Bornu gentleman wears a white gown, it is snow-white, and he looks like a gentleman. The Fulani are often dingy. They do not keep their horses as well as those of Bornu, but they are good horsemen. They will ride hard on rough ground, and are fond of exercises, such as spearing a lime on the ground at the gallop. They fight well against the Pagans, but have not hitherto done well against us, except at Burmi, where their fanaticism was in full swing.

The international position in the Western Sudan at present is as follows: Great Britain is in full occupation of Nigeria and British Bornu. Germany, governing from Duala, on the Kamerun seaboard, controls the Upper Kamerun or Lake Chad territories, with two or three companies posted at Garua, Dikoa, and Kussri. France, to the north of Nigeria, is on the borders of the desert, where the Tuareg problem has to be dealt with. Her country is connected by the waters of Lake Chad, across the angle of British and German territory, with Baghirmi. The projected railway across the Sahara from the Mediterranean to the lake will no doubt be given up, since there is nothing there to pay for the railway; but that across the desert by Ain Saleh to Timbuktu will probably be built. In Baghirmi, on the Shari, France is in considerable strength, watching the fanatical Moslems of Wadai. Up till now there has been great difficulty in relieving and supplying the Shari garrisons. The line of communication is extremely long, being by way of the French Congo, along the Congo and Ubanghi, over the watershed, and down to the Shari valley—a journey of four or five months. It is possible, however, that this will be altered, as a result of Commandant Lenfant's recent discovery. That officer, acting on the theory that the great Tuburi marsh might in the rainy season form a waterway between the Kebi and Logone rivers, started up the Benue in the latter part of 1903, and succeeded, under considerable difficulties and dangers, in getting a light boat through from Garua, on the Benue, by way of the Kebi, the Tuburi marsh, and the Logone, to the Shari. It was a fine piece of exploration, and fully earned the welcome he received when he returned to Paris.

Commandant Lenfant now suggests that the Baghirmi country should be evacuated on account of its want of resources, and that the French should be posted in the western angle of the frontier, near Lata, in the Kebi valley, where there is a rich country, and continuous water-communication by the Kebi, the Benue, and the Niger to the ocean.

We left England with the German Commission on January 17, 1903, and arrived at Lokoja on February 10. Leaving Lokoja and civilization on the 20th, we travelled 250 miles up the Benue by canoe to Ibi, and then marched another 250 miles, arriving at Yola on April 4. Four months were occupied in astronomical work and the triangulation of the Yola arc. August was spent at Yola in recording results and re-organizing the carriers, and on September 1 the headquarters of the commission crossed the Benue and started north. The survey was pushed rapidly across the hills, a distance of about 100 miles, under considerable difficulties of weather, the rainy season being at its height. Later, in the Bornu plain, a great delay was caused by the necessity of cutting avenues through the thick bush for the triangulation. By the end of the year, however, we reached Kukawa; and by the middle of February, 1904, the work was finished on the shore of the lake. Marching south, we left Yola for home on April 4, just one year after we marched in.

The Niger and the Benue are, of course, the two important waterways of Nigeria, and are to us of vital importance in facilitating communication and the supply of outlying stations. The Benue is almost as large a stream as the Niger. Its bed, for a long distance above Lokoja, is perhaps a mile wide in many places, with banks from 15 to 20 feet high, and a sandy bottom, whose shape is constantly altering. In flood time it runs bank high, and in many places overflows. At the end of the dry season there is so little water left that there is sometimes difficulty in getting passage for a canoe drawing 9 inches of water. At Yola, nearly 600 miles (as the river flows) from the confluence at Lokoja, I have forded the river in the dry season with the water no higher than my horse's girths; and on September 1, towards the end of the rains, it took me an hour to get across in a fast canoe, the stream being about three-quarters of a mile wide and very strong. In flood time the river is navigable as far as Garua, 70 miles above Yola, by river steamers drawing 4 or 5 feet. At low water one may travel very comfortably in flat-bottomed steel canoes, of which, however, there are very few available, or in large native dug-outs, about 40 feet long and 4 feet beam, with shelters built amidships to keep off the sun. We started in a steel canoe which had been fitted with engines and a stern wheel, but she broke down 30 miles above Lokoja, and we had to go on in the best canoes we could get from the river-side villages, ordinary dugouts without shelters. We sat in these from sunrise to sunset for eighteen days, camping at night on the banks, and certainly began our African experience with a baptism of fire. We had arrived at Lokoja with somewhat trusting natures, and had been confidently assured that the steam-canoe would run us up to Ibi in three or four days, so we provisioned for a week. Of course everything ran out—flour, tinned meat, coffee, jam, whiskey, etc.—and we found the supplies in the river-side villages extraordinarily scanty. We just managed to get enough skinny goats and chickens to keep us going, with yams and guinea corn, out of which we made porridge and "bush-cakes," a sort of inferior damper. Now and then we passed some fishermen, and got fish.

After this rather tedious experience, it was a relief to get to Ibi, where we found the two officers of the escort waiting for us, and where they had collected carriers and horses. We had decided to march the rest of the way to Yola, as the river above Ibi was so low that there would be difficulty in getting through. A party of the Commission followed us by water with stores a fortnight later, but with much trouble, having to dig channels through the sand in many places.

We now had our first experience of carriers, one of the great problems of African travel. Although the construction of roads is being rapidly pushed forward now, when we were in Nigeria there were none, and wheeled transport was therefore impossible. African bush paths are the same everywhere—tracks worn by naked feet, irresponsible, infinitely devious, turning aside here to dodge a thorn branch grown across the track, there to avoid a pool of the last season's rain, but in general direction pursuing a wonderfully even course from village to village. In thick bush they are very tiring to ride over, as you must go at a walk all day, stooping and twisting constantly in the saddle to avoid trees and overhanging boughs. In the rains the tracks, which are below the surface, become channels for running water. In Bornu, where there are large open and treeless stretches, there is another difficulty, for the black earth is parched and cracked by the sun until there is hardly a clod left large enough for man or horse to put foot on. Again, in other parts, such as the Garua district, the surface skin of the earth rises up like a sort of blister, and when this is softened by the first rains, your horse is apt to put his foot through it, with possibly serious results.

Luckily, elementary road-making in Nigeria is extremely easy. It is a mere question of clearing bush, cutting down small trees and avoiding large ones; the long coarse grass can be pulled up by the roots and thrown aside, and the light soil is easily raked to a smooth surface. Anything like a metalled surface is of course out of the question, as, except in the hills, there is little stone in most parts. Rivers could be crossed by providing rafts of tree-trunks where no canoes are available. At present in the rains one must ford or swim. The most difficult problem is the swamps, which are very common in the rainy season, so much of the country, even the bottom of the valleys among the hills, being quite flat, and having no natural drainage. Going north from the hills into the Bornu plain at the end of the rainy season, when the whole country was water-logged, we marched for three days through practically a continuous swamp, the water being in places as much as 4 feet deep, with a soft bottom. No ordinary engineering can deal with that, and such districts must remain difficult in wet weather.

At Ibi a force of three hundred carriers had been collected, with some difficulty, as the supply is now less than the demand. These were mostly professional Hausa carriers, fine specimens many of them, who stayed with us throughout the journey. Though they gave us a good deal of trouble at the outset, they shaped wonderfully under discipline and fair treatment, and we had a real respect and liking for many of them at the end. They are irresponsible, and must be treated like children; but, like children, they have a strong sense of justice. If they have earned punishment, and it is meted out to them dispassionately, they take it without bearing a grudge. When they have a fit of the sulks, a word of chaff or a little serious reasoning brings them out of it very easily; but they like to have their grievances listened to. Their faults are mostly on the surface, but pretty well marked. They fight, drink, and gamble, and if they are not kept well in hand they are a pest to any country they pass through, sheep-stealing and robbery with violence being their natural pursuits in moments of leisure. Thanks to the experience of Captain MacCarthy Morrough, who commanded the escort, we made a practice from the outset of camping outside villages, and not allowing the men into them. If any king, as the local headmen are called, complained of theft or assault, the carriers were paraded; if the offence was proved, and the sinners identified, they were punished and the victim compensated. We thus acquired a reputation for fair dealing which preceded us, and was of great use when we got into parts where the white men and his ways were little known, and where the advent of a small army of soldiers and carriers seemed like a serious menace to the population.

With these faults they have the virtues of patience and endurance. They will do heavy marches on half or even quarter rations without a murmur if they know you are doing your best to get food for them. A full day's ration, as much as they can eat, is 3 lbs. of flour. With this they like occasionally, as a treat, a small fragment of meat. The flour is made into porridge, and with soup from the meat and a little of a vegetable like spinach to flavour it, they have a feast, but usually they live on the porridge alone. Sometimes they like to gorge themselves on meat, and no part of an animal comes amiss to them; but if you feed them on meat alone, especially beef, for two or three days, as we sometimes had to do, they get sick.

At Yola we found the Fulani inhabitants not inclined to be friendly, but the Hausa and others who were not of the ruling class before our arrival had no prejudices. Away from Yola, especially in out-of-the-way places where they had not been much in touch with the ruling clique, there was less bad feeling among the Fulani. They are, however, not satisfactory people to deal with, being unpractical and unreliable. Of all the people with whom we came in contact—Hausa, Bornu, Pagan, etc.—I consider them the most untrustworthy. They are grasping, but lazy, and their intelligence is unproductive, and seems to have found its vent only in ruling without governing. My relations with them were chiefly on the food question, which was a constant anxiety and preoccupation. One reason for this was that there was an actual scarcity of corn, in fact, something approaching to a famine, while we were in Adamawa. Another, that, owing to the absence of markets of any size and the impossibility of dealing direct with the people, we had to get the supplies from the "kings" or headmen of towns, and no doubt very little of the cloth paid to them found its way to the actual growers. They were thus unwilling to bring it in, and the authority of the kings was not enough to make them.

The process of obtaining supplies under these conditions was always extremely irritating. You arrive at a village perhaps at three o'clock, after the day's march, send for the king, and tell him you want, say, eighty calabashes of corn. He promises earnestly to send this immediately, and retires to give orders. At six o'clock, as it is getting dark and you are losing patience, a procession of women comes out bearing twenty calabashes. You say that you must have more at once, and, after many promises and messages, perhaps at nine o'clock another small supply comes. Meanwhile you have been waiting to give out rations, and the carriers are going to sleep after another hungry day. It is a farce that is played with endless variations. A really good interpreter, a man of importance who carries weight with the people, is the best solution of the difficulty.

The relations of the Pagans with the Fulani in Adamawa were of considerable importance to us. I have mentioned that it was chiefly thanks to their horses that the latter defeated them and drove them to the hills. The greater part of Adamawa is hilly, the Kamerun range extending northward through it to the edge of the Bornu plain, about 100 miles south of Lake Chad. These hills are of granite, and may perhaps be called mountains, as they range from 1000 to 3000 feet above the river-level, which is here 1000 feet above the sea. They lie in very irregular isolated masses, ridges, and peaks, separated from each other by comparatively level valleys, where, when the bush is cleared, cavalry can act. The Bere hills just south of Yola (shown on the hand map) give an example of such an isolated mass.

The relations between the men of the hills, the plains, and valleys are practically the same as those of the highlands and lowlands of Scotland two hundred years ago. When the hill mass is large, as in the Pakha, Mandara, and Kilba regions north of the Benue, the tribes become powerful, and are not only safe in their hills, but can exercise influence in the neighbouring plains. In the smaller mass of Bere hills they are safe, but dare not venture into the plain, except for an occasional cattle-raid. In the isolated hills they live miserably, cut off from the rest of creation, and only existing by sufferance of the Fulani. It is needless to add that the hill tribes have their feuds among themselves. Some tracts of bush at the foot of the hills are a sort of no-man's-land, where neither Pagans nor Fulani dare venture for fear of the other party.

It was, of course, from the Pagans that the Fulani drew their slaves, and they used to make annual raids into the outlying hills for the purpose, as did also the Bornu people.

The state of armed isolation in which these people live makes them, of course, intensely suspicious of the outside world. Some tribes are quite impracticable; but with most of them we did not find it difficult to establish friendly relations. Our usual plan was to get a man from a village in the foothills who had some relations with the hill people, and had seen our ways, and could report well of us, and send him up with a message and a small present of cloth. Upon this the king would come down to our camp and have a talk, and next day would guide us up to his hill. Approached like this, we found them simple and friendly, curious as monkeys, delighted with small presents, and anxious to help in putting up survey-beacons or other ways. Physically they varied a good deal; some tribes had a good deal of the missing-link type, while others were quite fair specimens of manhood. They are good farmers, and their fields in the hills look very neat, and are far better kept than those of the Fulani.

One result of the state of isolation and mutual fear in which these people all live is the extraordinary difficulty of getting correct information about the country. The fog of war is nothing to it. For instance, when we were in the foothills of Alantika, not 30 miles from Yola, at a time when food was very short, I was told that at a place called Uomini, at the foot of the hills, half a day's march away, there was a powerful and warlike Pagan king who had a town far bigger than Yola and plenty of food. I sent a message to him that I was coming in a day or two, and wanted food. The messenger came back saying that he had been driven out by the king, who told him that he would have no white men there, and if we came he would fight. I sent another and more reliable messenger to tell the king that I came as a friend, but that if he made trouble, I had soldiers enough with me to burn his town and twenty like it. In point of fact, we had at that time six soldiers in camp, but it was not necessary to say so. The second messenger came back, saying that the king had climbed down; he had plenty of food, and would send it or keep it for us as might be ordered. The ridiculous end to the affair was, that when we reached this rumoured stronghold we found a Pagan village of about five hundred people, and a decrepit and apologetic king who claimed a sovereignty, which no one else allowed, over some neighbouring villages—and there was no food.

Although we had some sympathy for the Pagans, as being, perhaps, on the whole more sinned against than sinning in their relations with their late Fulani rulers, it must be allowed that they are the chief source of trouble in the country. The plains people understand and recognize British authority, but the Pagans are Ishmaels, recognizing no one, and, like the little girl with the curl, "when they are bad they are horrid." They are especially mischievous in interfering with trade by blocking roads and murdering traders. This reminds me of a trader who wanted to join us for protection when we marched south from Dikoa. He could not get away in time, but he caught us up at Uba, about 100 miles farther south. He was dishevelled, but very pleased with himself. He told me that he had been stopped by the people at Dure, who had taken his merchandise and his wife; but when they wanted his horse, he said, "No, no;" he drew the line there, and he beat them off with his spear and got away. His point of view was quite simple: he had probably paid about the same amounts for the horse and the wife, but the horse was indispensable to enable him to get away, and the wife was not. This seems, in fact, to be the normal point of view of the native. It very often happened that a man would come and complain that his wife had run away with one of the carriers, and the burden of his complaint always was that he paid so much—perhaps £3—for her two or three years ago. When the lady was sought out and produced, and he was asked if he wanted to take her back, he always said he would rather have the money.

Turning now to geographical considerations, the most important question, of course, is Lake Chad. In order to give a general idea of the southern drainage system, the results of Commandant Lenfant's recent exploration have been added to the hand-map. They are taken from the map at the end of his book, 'La grande route du Tchad.'

Considering first the hills, we find that south of Yola they are spread in irregular masses, separated by well-marked valleys, covering a space of perhaps 100 miles from east to west. Of this country we have at present no accurate surveys. The Benue, from above Garua to Yola, flows through a great valley, of more or less oval shape, some 80 miles long by 40 wide. North of this valley we have still the same irregular masses, a broken sea of granite peaks, as in the south, whose summits are all at about the same level, of 1500 to 2000 feet above the river, which at Yola is nearly 1000 feet above the sea. Fifty miles north of the river, however, beyond Holma, we open up the Yedseram valley, which runs uninterruptedly, broadening as it goes, north-north-east along the boundary, into the Bornu plain. East of the valley, in German territory and separating it from the Musgu flats, runs a mountain chain of striking character, gradually narrowing till it terminates in an isolated peak at Zalladufa. In the southern portion of this range, where the granite predominates, are some of the most remarkable rock formations that I have ever seen, natural towers, battlements, and pinnacles crowning the hills, and giving individuality to each one. On one of them there is probably the finest natural obelisk in the world. This is Barth's Mount Kamalle, but it is so slightly mentioned by him that he must have seen it in a bad light. Standing symmetrically on the summit of a high conical hill is a gigantic pillar of rock. Seen from 20 miles away through the clear atmosphere of the rains, it looked like a huge factory chimney. Measured with the theodolite, it appeared to be 450 feet high, and 150 feet thick at the base.

All the granite country of Adamawa is picturesque, even in the dry season. In the rains the soft pinks and greys of the rock, half veiled by creepers and long grass, are wonderfully pleasing after weeks of riding through the dreary African bush. The Mayini valley, south of Yola, would be thought beautiful even in Europe. There are green glades studded with great shade trees, a silver river winding through them, softly undulating wooded hills around, and in the distance the granite peaks, with a bright thread of waterfall—everything that delights the educated eye.

On the western side of the Yedseram valley the hills are scattered in less-defined masses, and present no special features.

The watershed between the Benue and the basin of Chad is near Mubi, where the Kilunga and Yedseram rivers, issuing from the hills to the west within 5 miles of each other, flow south and north respectively. Beyond the eastern hills, the water-parting is at the Tuburi marsh. This great swampy lake lies on a plateau considerably above the Benue valley, and feeds both the Benue and Chad. It is drained northward through the Musgu and Kotoko flats by the Logone, and westward over the cataract of Lata, 370 feet high, by the Mayo Kebi to the Benue. The success of Commandant Lenfant's mission lay in discovering the connection, and proving that there is a practicable waterway in the rains for boats drawing 2 feet. It is now possible to go by water the whole way from the Niger to the Shari with only one portage, at the cataract of Lata.

The Yedseram river and the Tuburi supply, of course, a good deal of water to the lake, but by far the most important feeder is the Shari, of which, indeed, the Logone is only a tributary. After the Shari in importance is the Yo river, coming from the highlands of Kano.

Considering the lake generally, and the changes which are taking place in its shape, we find that these are occurring in the east and south. On the east it is being filled up by the sand blown from the desert, aided by luxuriant growth of vegetation. On the south, the loss of area is principally due to the dropping of the surface level. The presumption is that the rainfall is decreasing; partly, no doubt, in consequence of the deforestation of the country, which is aided by the annual burning of grass and bush by the natives. This point is well brought out by Lenfant. The bed of the lake in the south is so extremely flat that a shrinkage of a few inches in the surface level makes a sensible difference in the area of the lake.

The lake, as we know it, is the residuum of a far larger inland sea, which must have extended southward to the base of the Marghi and Mandara hills, and far towards the Tuburi marsh. Lenfant is of opinion that this sea discharged itself through the Benue into the Atlantic, that the connection was lost by subsidence, and that the desiccation has been going on ever since. Whether there was such a connection or not, I certainly formed the opinion, when in the mountains south of Yola, that the Benue was once of immense volume, and that not only the Benue valley, but the valleys among the hills, several hundred feet above the present level of the river, were formerly under water.

Following the valley of the Yedseram, we find stony ground and outcrops of rock as long as we are quite close to the base of the hills. When we leave them, for a few miles there is gravel, gradually growing finer, then sand. From this on the country is almost dead level, and we soon come to the deposits of sediment (known as the Bornu black earth) that mark the comparatively recent presence of the lake. Westward, that is south-west of the lake, the ground undulates slightly, and there on the higher levels the surface is all sand, with a slight admixture of humus.

To the east the ground is all of the nature of a delta, covered with swamps in the rains, and partially drained by an infinite number of shallow channels. The great difficulty of surveying these has led to inaccuracy in previous descriptions of the course of the rivers. Thus Barth describes the Maiduguri river as flowing by Dikoa and Ngala to the lake. So much respect is due to Barth's statements, that it would be unsafe to say that it did not do so in his time; but at present it flows past Maiduguri in the opposite direction, and, as far as we could conjecture, must lose itself in the sand somewhere to the north-west, as there was no recognizable outlet for it to the lake between Dikoa and Kukawa. The Yedseram river flows by Dikoa, but a few miles further on loses itself in an extensive marsh, and only a portion of its water gets down to the lake by a well-marked channel that drains the north side of the marsh past Urge; and it is apparently the Bahr Afade, a branch of the Logone, that flows past Ngala. This river continues to flow till late in the dry season, long after the Yedseram swamp has dried up.

There can be no doubt, from the French observations, that the shrinkage of the lake, due to the deposit of desert sand on the eastern shore and in the Shari delta, is going on fast; but I do not think that the level of the lake is falling as rapidly as is generally supposed. This is a point on which it is impossible at present to have definite knowledge, as the level varies so much from year to year according to the rainfall. Native evidence, of which I took a great deal, is vague, and not always consistent. Some will tell you of a cycle of eleven years governing the highest floods. One old man told me that forty years ago the floods used to come every year close round the walls of the town of Seram, opposite Ullgo (perhaps 8 feet above the present low-water level of the lake), but that they have been gradually receding ever since. Colonel Destenave gives 4 feet as the difference between high and low water, from his observations in 1902. I am inclined to think that the old native exaggerated his maximum level largely.

As regards the alleged continuous fall in the floods, we have, on the other hand, the fact that the great flood in 1854, recorded by Barth, and Rabeh's flood, as it is called, in 1893, both reached approximately to the same point on the west, namely, the town of Ngornu.

Perhaps the most interesting feature about the lake is the second flood. The first rise of the lake comes with the rains; the second, which is expected to be the greatest, comes in the middle of the dry season, about Christmas.

The rainy season is over in Bornu towards the end of September, at which time most of the country for miles round the south end of the lake is under water. By the middle of November the flood of the Shari is practically over, and the smaller rivers are bringing down nothing. The lake recedes, and at Christmas rises again, as a rule higher than before. The rise is, therefore, not due to the rivers, or to rain; it comes after a spell of the strong north-east wind. The natives say, "Chad likes cold." It was most unfortunate that in the winter of 1903–4, when we were there, the second flood failed altogether.

It is on the southern bay of the lake, which is almost entirely filled up with long grass, bulrushes, and marya, growing 8 or 10 feet above the water, that one gets the clearest descriptions of this rise, which is a real definite rise. One gets no clear account of a similar rise on the open western share. There the water, when driven before the strong north-east wind, may spread itself from time to time over half a mile or so of the flat ground, and retire as soon as the wind goes down. It is possible that the second flood, as it was described to me, may occur only in the southern bay; that the northern edge of the area of vegetation blocking this bay may resist the pressure of the water driven by this wind for a certain time, and then when it yields the water rushes in; but I do not venture to offer an opinion.

A few notes on the survey operations of the commissioners, which were carried out by Captain Whitlock and Lieuts. Jackson and Doucet, R.E., may be of interest.

For the longitude of Yola, the British commission relied on occultations, using a 2½-inch astronomical telescope made by the late Dr. Common. It was an excellent instrument, but a larger one would have been better. The German commission took out a fine altazimuth, with a special observatory tent and materials for making a concrete pillar, and they worked by moon culminating stars. For the special conditions under which we worked, this method was probably the best, for several reasons, one of which was that we could not reach Yola before the clouds began to gather for the wet season, and consequently most of the occultations were hidden; but, as a general rule, I should certainly recommend the occultations.

The base for the triangulation was 1¼ mile, that being the longest that could be got on fairly level ground. It was measured four times with a 100-feet steel tape, the greatest difference between the measurements being 8 inches. A 400-feet steel tape was tried, but was found difficult to handle. From this base, triangles were built up until we got a line about 32 miles long from Mount Bagele to Beruere. The length of this line was worked out from two separate sets of triangles, which gave results agreeing within 6 inches. It was the base for the triangulation carried up to the lake, as well as for the Yola arc of about 30 miles' radius. The theodolites used were a 6-inch and a 5-inch micrometer microscope (by Troughton & Simms), which answered extremely well, though they had unavoidably some very rough usage.

A good deal of trouble was experienced in laying out the small triangles from the original base, on account of the difficulty of getting points of view in the undulating and thickly-wooded valley of the Benue. Once in the hills, this difficulty disappeared, not much clearance as a rule being required.

The triangulation beacons were tripods of poles, mostly 12 to 15 feet high, about 4 feet of the top being covered with straw mats, which were worked to a point at the top; the tips were bound with black and white cotton cloth. For the longer lines, heliographs were used in conjunction with the beacons.

When we left the mountains, going north into Bornu, a great difficulty appeared in the flatness of the country, which was also densely wooded. This was made worse by the fact that most of the country north of the hills was at that time under water, and marching was extremely difficult. After a good deal of trouble, a couple of points were found near Malmatari, from which the peak of Zalladufa could be seen.

The longitude of these was got by latitude and azimuth, and thus a fresh base was obtained.

At Malmatari we were 30 miles from Dikoa, and the whole distance was covered with thick bush, with a great many hard-wood trees, through which avenues had to be cut for the triangulation. This work was very tedious, the rate of advance being only half a mile a day. As I had been told that Bornu was practically treeless, we were very short of tools, and had to fall back on native axes. Luckily, after our experience in the Benue valley, I had got up several 5-feet crosscut saws from Lokoja, which were invaluable. We ought to have had five dozen felling axes, six crosscut saws, and some guncotton. The work was done by the carriers. They did not like it, and, if the Pagans had not been between them and their homes, would have deserted *en masse*; but they worked well after they got used to our tools.

After Dikoa, though we sometimes met with bad stretches of bush, the work was not so heavy, some of the ground being absolutely clear, with nothing growing but coarse grass.

A further difficulty, caused by the heat in Bornu, was that, owing to the vibration of the atmosphere, it was impossible to observe accurately except for an hour after sunrise and an hour before sunset.

The results of the triangulations carried up from Yola by the British and German commissioners differed at Kukawa by 11 seconds of latitude and longitude.

Before the paper, the PRESIDENT: I have great pleasure in introducing Colonel Jackson to the meeting, who has been employed on the Anglo-German Boundary Commission, and has done a great deal of very valuable geographical work. I am quite sure the paper he is going to read to you this evening will be extremely interesting. I now ask Colonel Jackson to read his paper.

After the paper, Colonel ELLIOT: I did not expect to be called upon, but I have listened with great interest to what Colonel Jackson has said, and I notice he had very much the same difficulties as I had. He spoke a good deal about food. Food is one's first thought, and it is a very great difficulty to get food in these districts. Another question was transport—that was also a great difficulty. Colonel Jackson appears to have suffered a great deal from swamps. I suffered from the opposite—lack of water and dust. I also had the same difficulty as he had about the question of the ladies with our own caravan, and eventually I had to give in. I found them fearful thieves; that was what I objected to them for chiefly. They would go into the village and lay their hands on whatever they could, and get the men into trouble. But I found they were such good cooks, and looked after the men so well—and our men had very hard work indeed—that eventually, without saying so, I had to give in on that point. Colonel Jackson has thrown a lot of extra light on the subject of Lake Chad. I was not there as long as he was there, and I was very much puzzled to account for the rise and fall of the lake. I noticed bones of large fish at some considerable distance away from the shores of the lake, which shows there is a great rise and fall of the lake. I understand that there was a sort of periodical rise and fall of the lake; the lake had a period of some years, but, from what Colonel Jackson says, it is an annual or a biennial period. What Colonel Jackson saw I saw in a less degree. My first view of the lake was very much what Colonel Jackson described. You came on the lake without knowing you were there. We came out of a patch of bush, crossed a grassy plain covered with game, and then we saw greener grass ahead, and there was water; we kept on getting into deeper water, and we were in Lake Chad. But there was no large open stretch of water such as we expected to see. I think that is about all I can say on the subject.

The PRESIDENT: We have to thank Colonel Jackson for a most interesting account of his journey from the Benue to Lake Chad, and for his account of the people and the incidents of his travel. It was very pleasing to hear this testimony to the nerve and pluck of Captain Lenfant, who has done so much to add to our information respecting this very interesting region. The latter part of Colonel Jackson's paper gives us some notion of the changes that have taken place, probably within historic times, many of them caused by the action of man, in this great region, which has altered the flow of rivers and very much reduced the size of the once great inland sea. I am sure you will all wish to join with me in a very cordial vote of thanks to Colonel Jackson for his most interesting paper.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

PART VIII.—THE LOCHS OF THE CONON BASIN.

IN this paper it is proposed to deal with the lochs draining into the Cromarty firth, which were surveyed by the staff of the Lake Survey, viz. Lochs Crann, a' Chroisg, Gown, Achanalt, a' Chuilinn, Fannich, Luichart, Beannachan, Achilty, Garve, Kinellan, Ussie, Glass, and Morie.† The majority of these lochs drain by the river Conon into the head of the Cromarty firth, while Lochs Glass and Morie drain by independent streams, which fall into the Cromarty firth on its north-western shore. It has been found convenient, also, to include in this paper a description of Loch Eye, situated between Cromarty firth and Dornoch firth. The drainage area under consideration is indicated in the small index map of the district shown in Fig. 1, by reference to which the relations between the various lochs will be readily understood, and extends from the mouth of the Cromarty firth on the east to the heights of Carn Breac and An Groban on the west, Carn Chuinneag on the north, and Sgorr a' Choir-Ghlais on the south. The total area, as measured by the planimeter on the 1-inch Ordnance Survey maps, is over 770 square miles, and of this total 336 square miles (or one-half) drain into the lochs now to be dealt with, as will be seen from the summary table at the end of this paper.

The headwaters of the basin take their rise on the flanks of Carn Breac, flowing by various streams into Loch na Moine Moire and Loch

* Plates, p. 128.

† The names of the various gentlemen who have taken part in the survey of the lochs in this basin will be found recorded on the maps.

an t-Sior (which were not sounded), thence into Loch Crann and Loch a' Chroisg, the outflow from which is carried by the river Bran into Loch Achanalt and Loch a' Chuilinn, and thence into Loch Luichart. Shortly after leaving Loch a' Chroisg the river Bran receives the outflow from Loch Gown, which is fed by the Allt Gharagain, taking its rise on the flanks of Moruisg (3026 feet), and shortly before entering Loch Luichart the river Bran is joined by the river Fannich bearing the outflow from Loch Fannich, which is fed by various streams draining the flanks of a grand series of mountains exceeding 3000 feet in height. After the junction of the Bran and the Fannich the river receives the name of Conon, and shortly after leaving Loch Luichart it

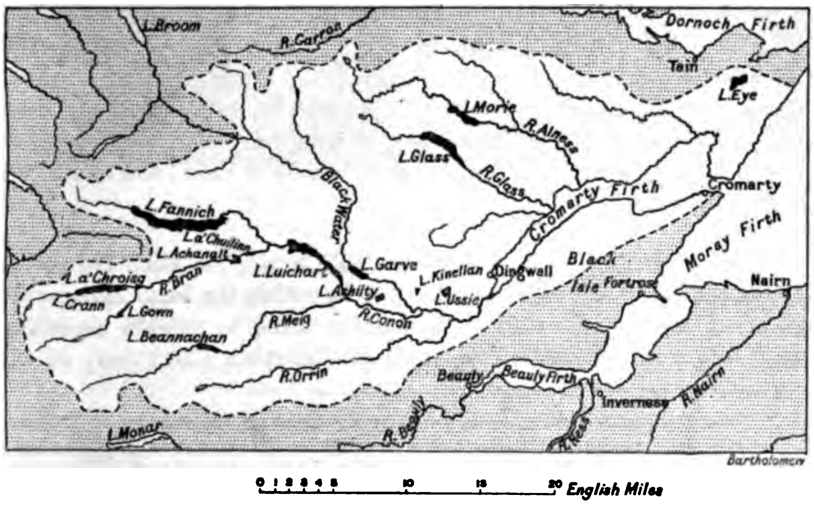


FIG. 1.—INDEX MAP OF THE CONON BASIN.

is joined by the river Meig, bearing the outflow from Loch Beannachan, taking its rise among lofty mountains culminating in Sgurr a' Chaoruinn (3452 feet). Still further on the river Conon is joined by the Black Water, bearing the outflow from Lochs Garve and Achilty, and taking its rise far to the north on the flanks of Beinn Dearg (3547 feet). Still further on the river Conon is joined by the river Orrin, and finally falls into the head of the Cromarty firth at Dingwall. The river Glass, which in its course flows through Loch Glass, rises on the flanks of Beinn nan Eun, and empties itself in the Cromarty firth at Balconie Point. The river Alness, which flows through Loch Morie, rises on the flanks of Beinn a' Chaisteil, and falls into the Cromarty firth at Alness Point.

The geology of the district is dealt with by Drs. Peach and Horne, whose notes are appended to this paper, as well as a few biological notes by Mr. James Murray. Mr. R. M. Clark, B.SC., who took part in the survey of the lochs in the Conon basin, has supplied us with several series of temperatures taken by him the previous summer (1901) in Lochs Achilty, Garve, Achanalt, a' Chuilinn, and a' Chroisg, which are here incorporated.*

Loch Crann (see Plate I.).—Loch Crann is a small shallow loch situated a short distance to the west of Loch a' Chroisg, and lying at a slightly higher level. Its striking characteristic is the large area of hilly country draining into it—an area nearly six hundred times greater than that of the loch. It is roughly quadrangular in outline, with a maximum diameter of less than a quarter of a mile, and it covers an area of about 13½ acres, 80 per cent. of which is under less than 10 feet of water. The deeper soundings were taken in the southern half of the loch, the maximum depth observed being 17 feet. The volume of water is estimated at 4 million cubic feet, and the mean depth at nearly 7 feet. Loch Crann was surveyed on August 19, 1902, when the level was determined as being 513·7 feet above the sea. The temperature of the surface water at 5 p.m. on that date was 59°·6 Fahr., and at a depth of 14 feet 56°·2.

Loch a' Chroisg (see Plate I.).—Loch a' Chroisg (or Loch Rosque) is one of the larger and more important lochs within the basin, lying amid beautiful scenery, the hills on both sides rising to heights exceeding 1500 feet, and culminating in Meall a' Chaoruinn (2313 feet) on the

* These temperature observations, taken by Mr. Clark in the summer of 1901, are interesting, as compared with the observations taken in the same lochs in the summer of 1902, when viewed in connection with the atmospheric conditions in the two seasons. It will be observed that all the readings taken in the superficial waters of these lochs in 1901 are higher than those taken in 1902, and this is evidently related to the warmer season in the first-named year. Thus the mean temperature over Scotland for July, 1901, was 61°·8 Fahr., or 3° above the long-period average for that month, while for July, 1902, it was 54°·4, or 4½° below the average; for August, 1901, the mean was 57°·5, or 1° above the average, while for August, 1902, the mean was 53°·9, or 2½° below the average. The nearest station to the Conon basin lochs from which observations are available is Inverness, and the mean temperature there for July, 1901, was 61° 0, or 4° above the long-period average, while for July, 1902, the mean temperature was 45°·4, or 3½° below the average; for August, 1901, the mean was 58°·7, or 2° above the average, while for August, 1902, the mean was 54°·2, or 2½° below the average. Sunshine records are available for Strathpeffer within the Conon basin during these seasons, and they bear the same relations: thus during July, 1901, 162·1 hours of sunshine were recorded at Strathpeffer (or 34·5 above the normal for that month, and 30 per cent. of the possible amount), while during July, 1902, the duration of sunshine was 95·6 hours (or 32·0 below the normal, and 18 per cent. of the possible amount); during August the difference was not so marked in the two years, the duration in August, 1901, being 140·0 hours (or 18·5 above the normal, and 30 per cent. of the possible amount), while in August, 1902, the duration was 131·8 hours (or 10·3 above the normal, and 28 per cent. of the possible amount). The sunshine records for Inverness agree closely with those given above for Strathpeffer for the two seasons under consideration.

FIG. 2.—LOCH A' CHROISG, LOOKING WEST.
(*Photo by T. N. Johnston, M.B., C.M.*)

FIG. 3.—LOCH FANNICH, LOOKING EAST.
(*Photo by T. N. Johnston, M.B., C.M.*)

northern shore (see Fig. 2). It is a good trout loch, and char also occur, but the fishing is strictly preserved. The loch trends almost due east and west, though very slightly sinuous in outline; the shore-line is on the whole very regular, except that two conspicuous alluvial cones have been laid down on the northern shore at the mouths of the Allt Duchairidh and neighbouring stream. The loch is 3½ miles in length, with a maximum breadth of nearly half a mile, the mean breadth being over a quarter of a mile. Its waters cover an area of about 640 acres (1 square mile), and it drains directly an area of over 7½ square miles, but as it receives the outflow from Loch Crann its total drainage area is over 19 square miles. The maximum depth of 168 feet was observed approximately near the centre of the loch, opposite the mouth of the Allt Duchairidh entering the loch on its northern shore, and about 2 miles from the east end. The volume of water contained in the loch is estimated at 2057 million cubic feet, and the mean depth at nearly 74 feet. The loch was surveyed on July 30 to August 1, 1902, and the elevation of the lake-surface, on commencing the survey, was found by levelling from bench-mark to be 508·4 feet above the level of the sea; when levelled by the Ordnance Survey officers on July 3, 1868, the elevation was 507·9 feet above sea-level.

Loch a' Chroisg forms a simple basin with no pronounced irregularities of the lake-floor, as is well shown by the longitudinal and cross sections on the map; the contour-lines enclose continuous areas following approximately the outline of the loch. The 100-feet basin exceeds 2 miles, and the 50-feet basin is nearly 2¾ miles, in length, approaching in each case rather nearer to the east than to the west end of the loch, while the small 150-feet basin lies nearer to the west than to the east end. The approximate areas between the consecutive contour-lines drawn in at equal intervals, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 50	241	37·7
50 „ 100	186	29·0
100 „ 150	195	30·5
Over 150	18	2·8
	640	100·0

The slightly larger area between 100 and 150 feet than between 50 and 100 feet indicates the flat-bottomed character of the deeper part of the loch, and the soundings show in certain places rather steep slopes both off the northern and southern shores.

Temperature Observations.—In the following table are given the results of a series of temperatures taken in Loch a' Chroisg on August 22, 1901, by Mr. Clark, and of two series taken by the Lake Survey staff on August 1, 1902:—

Depth in feet.	August 22, 1901 (R. M. Clark).	August 1, 1902, ½ mile from E. end of loch in 106 feet.	August 1, 1902, Deepest part of loch in 156 feet.
	° Fahr.	° Fahr.	° Fahr.
0	58·2	55·0	54·0
20	58·2	—	—
25	—	53·7	53·9
40	58·0	—	—
50	—	53·1	53·2
60	57·6	—	—
75	—	53·3	51·0
80	51·9	53·2	—
90	—	50·5	—
100	48·5	49·9	49·1
120	47·5	—	—
150	—	—	48·9

The series taken in 1901 shows a range from surface to bottom amounting to 10°·7, whereas the two series taken in 1902 show a range of only 5° in each case, and an extreme range of 6°. The upper layers of water down to a depth of 60 feet were much warmer in 1901 than in 1902, but between 60 and 100 feet the 1901 observations indicated a fall of 9° (viz. a fall of 5°·7 between 60 and 80 fe.t, and a fall of 3°·4 between 80 and 100 feet), so that the temperature of the bottom layers of water beyond 100 feet was lower in 1901 than was observed at these depths in 1902.

Seiche.—On August 19, 1902, between 4.30 and 5.30 p.m., a seiche was observed by Mr. James Murray within the shelter of the pier at the east end of Loch a' Chroisg, a light west breeze blowing at the time. The amplitude was a quarter of an inch, and the period about 11½ minutes.

Loch Gown (see Plate I.).—Loch Gown (or Ledgowan) lies about a mile to the south-east of Loch a' Chroisg and is also a good trout loch, but the fishing is preserved. It trends in a north-east and south-west direction, is very irregular in outline, and about 1¼ miles in length. Though it may at one time have formed a single lake, it is now divided into two distinct lakes having, at the time of the survey, a difference in level exceeding 2 feet. This separation has probably been brought about mainly by the deposition of material laid down by the Allt Mhàrtuin, and the passage between them is obstructed by weeds, so that it is impossible to row a boat from one loch to the other, except after heavy floods. The two lochs are nearly equal in superficial area, but the southern basin is much deeper than the northern one.

South Loch Gown.—The southern loch is roughly quadrangular in outline, over half a mile in length, and nearly a third of a mile in maximum width, covering an area of about 55 acres, while it drains an area exceeding 13 square miles. The maximum depth of 52 feet was observed relatively close to the north-eastern shore. The volume of water is estimated at 38 million cubic feet, and the mean depth at nearly 16 feet. The loch forms a simple basin, the 10-feet contour following approximately the outline of the loch and extending a short distance into the passage leading to the northern loch, and the 25-feet basin is centrally placed. Of the entire lake-floor only 13 per cent. is covered by more than 25 feet of water. It was surveyed on August 2, 1902, when the elevation was determined as being 524·4 feet above the level of the sea.

North Loch Gown.—The northern loch is more oblong in outline than the southern loch, so that while nearly equal in length its maximum width is less, viz. about a fifth of a mile. Its waters cover an area of about 48 acres, and it drains directly an area of about 1 square mile; but since it receives the outflow from the southern loch, its total drainage area is over 14 square miles—nearly 200 times greater than the area of the loch. The greatest depth observed was 17 feet, approximately near the centre of the loch. The volume of water is estimated at 14 million cubic feet, and the mean depth at nearly 7 feet. A constriction in the outline towards the southern end of the loch is accompanied by a slight shoaling of the bottom, the result being that a small 10-feet basin near the southern end, with a maximum depth of 13 feet, is separated from the large main basin. Of the entire lake-floor 22 per cent. is covered by more that 10 feet of water. It was surveyed on the same day as the southern loch (August 2, 1902), and the elevation was determined as being 522·1 feet above sea-level.

Temperature Observations.—Serial temperatures were taken in the deepest part of each loch, with the following results:—

Depth in feet.	North Loch Gown, August 2, 1902, 1 p.m.	South Loch Gown, August 2, 1902, 4 p.m.
	° Fahr.	° Fahr.
Surface	55·7	55·0
10	55·7	55·0
15	55·7	—
20	—	55·0
30	—	53·8
40	—	52·1

In the shallow north loch the temperature was found to be constant from surface to bottom, and in the south loch the temperature was constant from the surface down to a depth of 20 feet (though more than half a degree lower than in the north loch); between 20 and 30 feet the fall was 1°·2, and between 30 and 40 feet 1°·7—a fall of nearly 3° in the 20 feet of depth.

Loch Achanalt (see Plate II.).—Loch Achanalt is an irregular shallow loch apparently in process of being silted up, the material brought down by the river Bran forming two long spits extending out towards the centre of the loch. The northern spit extends nearly across the loch, joining the islands, and leaving only a narrow passage close to the eastern shore, through which there was a strong current, and thus practically cutting the loch into two portions. The western shores are bordered by weeds. It flows into Loch a' Chuilinn by a short and rapid stream, the difference in level exceeding 4 feet; the Highland railway is carried over the passage between the two lochs. Loch Achanalt is approximately quadrangular in outline, its maximum diameter exceeding three-quarters of a mile, and it covers an area of about 160 acres, or one-quarter of a square mile. The deepest water was found comparatively close to the western shore, south of the entrance of the river Bran, where two soundings of 9 feet and two soundings of 8 feet were recorded. The volume of water is estimated at 31 million cubic feet, and the mean depth at 4½ feet—half the maximum depth. The area draining directly into Loch Achanalt is very large, exceeding 39 square miles; but since it receives the outflow from Lochs a' Chroisg and Gown, its total drainage area exceeds 72½ square miles, or 290 times the area of the loch. Loch Achanalt was surveyed on August 9, 1902, when the elevation of the lake-surface was found to be 365·1 feet above the sea; when levelled by the Ordnance Survey officers on May 9, 1870, the elevation was 364·7 feet above sea-level. The temperature of the surface water on the date of the survey was 57°·1 Fahr.; the temperature of the river Bran being 55°·2, and of the air 50°·8. On August 19, 1901, Mr. Clark observed a temperature of 60°·1 at the surface, and a temperature of 60°·4 at a depth of 5 feet.

Loch a' Chuilinn (see Plate II.).—Loch a' Chuilinn (or Culen) trends east and west, is irregular in outline, of varying width, and with an undulating floor. It is 1⅓ miles in length, with a maximum breadth of one-third of a mile. Its waters cover an area of about 113 acres, and it drains directly an area of nearly 1¾ square miles; but as it receives the outflow from Loch Achanalt, its total drainage area is over 74 square miles—over four hundred times the area of the loch. The maximum depth of 43 feet was observed approximately near the middle of the loch. The volume of water is estimated at 50 million cubic feet, and the mean depth at 10½ feet. The bottom of Loch a' Chuilinn is most irregular; close to the west end is a 10-feet basin, with a maximum depth of 29 feet, the slopes of which are in places steep, depths of 20 and 21 feet having been found close in-shore. Separated from this western basin by an interval of about 600 yards, in which the depth does not exceed 8 feet, lies the central 10-feet basin, enclosing the maximum depth of the loch (43 feet), and here again the slope is steep, one sounding of 29 feet being recorded close to the southern shore. Separated from this central basin by a short interval, 7 feet in depth, is a small eastern basin, with a maximum depth of 29 feet, and after another shallow interval the water deepens at the exit of the outflowing river, where soundings of 13 feet were taken. Of the entire lake-floor, 75 acres (or 67 per cent.) are covered by less than 10 feet of water, and 7 acres (or 6 per cent.) by more than 25 feet of water. The loch was surveyed on August 11, 1902, when the elevation of the lake-surface was found to be 360·8 feet above the sea.

Temperature Observations.—The following table gives the results of observations taken in Loch a' Chuilinn by Mr. Clark on August 19, 1901, and by the Lake Survey on August 11, 1902 :—

Depth in feet.	August 19, 1901 (R. M. Clark).	August 11, 1902.
	° Fahr.	° Fahr.
0	60·3	55·7
5	60·0	—
10	59·6	—
15	—	55·4
20	59·6	—
30	—	54·7
40	58·6	—

These observations show that the whole body of water was much warmer in 1901 than at the same season in 1902, the difference amounting on the average to about 4°; the range of temperature was in each case small.

Loch Fannich (see Plate III.).—Loch Fannich is the largest within the Cromarty firth drainage-basin, and is surpassed in depth only by Loch Glass. It is situated in Fannich deer-forest amid splendid scenery (see Fig. 3), the mountains along the northern shore rising to heights exceeding 3000 feet, including An Coileachan (3015 feet), Meallan Rairigidh (3109), Sgùrr Mòr (3637), Sgùrr nan Clach Geala (3500), Sgùrr Breac (3000), and A'Chailleach (3276). The trout-fishing is good, the fish being of fair size, but the loch is strictly preserved. The general trend of the loch is east and west, but the two ends have a tendency to bend slightly to the northwards. Loch Fannich is nearly 7 miles in length, the maximum breadth exceeding three-quarters of a mile, and the mean breadth is over half a mile. Its waters cover an area of 2300 acres (or over $3\frac{1}{2}$ square miles), and it drains an area ten times greater (over $35\frac{1}{2}$ square miles). The maximum depth of 282 feet was observed about $1\frac{1}{4}$ miles from the east end, and about $5\frac{1}{2}$ miles from the west end. The volume of water is estimated at 10,920 millions of cubic feet, and the mean depth at nearly 109 feet. Loch Fannich forms a simple basin, all the contour-lines enclosing continuous areas, though the deepest part (exceeding 200 feet in depth) lies in the eastern half of the loch. The 50-feet area extends from end to end, coinciding approximately with the outline of the loch. The 100-feet area approaches to within half a mile from both ends, and is nearly 6 miles in length; there is a slight shoaling of the water opposite Rudha Mòr to 103 feet, with deeper water to the east and west. The 150-feet area is distant over 2½ miles from the west end, and is over 3½ miles in length. The 200-feet area is 2½ miles, and the 250-feet area 1¾ miles, in length, and they approach to within three-quarters of a mile from the east end. The slight shoaling opposite Rudha Mòr has already been referred to, and a similar shoaling is observable within the 200-feet contour opposite Fannich Lodge, where the depth decreases from 226 feet to 212 feet, and increases again on proceeding eastwards into the 250-feet area; these two shoalings are indicated in the longitudinal section A–B on the map. A sinuosity is also seen in the 200-feet contour off the southern shore, opposite Fannich Lodge, due to the shoaling of the water from 202 to 191 feet, but on the whole the lake-floor may be said to be extremely regular in conformation. The cross-section C–D is taken across the loch in the position of the deepest sounding. The areas between the consecutive contour-lines drawn in at equal intervals, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 50	658	28·6
50 „ 100	582	25·2
100 „ 150	418	18·1
150 „ 200	272	11·8
200 „ 250	220	9·6
Over 250	155	6·7
	2305	100·0

The regularity of the average slope of the bottom is indicated by the gradually decreasing areas between the contour-lines, and the comparatively large area within the deepest contour indicates the flat-bottomed character of the deeper part of the loch.

Loch Fannich was surveyed on August 13 and 14, 1902, and the elevation of the lake-surface was found, on commencing the survey, to be 821·9 feet above sea-level, which is identical with the level observed by the Ordnance Survey on May 27, 1870.

Temperature Observations.—The temperature of the surface water during the two days spent on the survey varied from 52°·7 Fahr. to 58°·1 (the air-temperature during the same period varying from 51°·8 to 57°·9). Two serial temperatures were taken on August 14, 1902, with the following results:—

Depth in feet.	August 14, 1902, 4.15 p.m., deepest part of loch.	August 14, 1902, 5.30 p.m., south-east of Rudha Mòr.
	° Fahr.	° Fahr.
Surface	53·0	54·0
5	52·0	—
10	51·9	—
20	51·6	53·0
40	—	52·5
50	51·0	—
70	—	50·0
100	48·6	46·7
130	—	45·7
150	45·6	—
200	44·9	—
250	44·5	—
281	44·4	—

Each of these series shows a range from surface to bottom of about $8\frac{1}{2}$°. The temperature was higher in the upper 40 feet of water towards the west end of the loch than in the deep water towards the east end, but at the depth of 100 feet the temperature was 2° lower in the former position. Off Rudha Mòr there was a fall of 2°·5 between 40 and 70 feet, and a further fall of 3°·3 between 70 and 100 feet (equal to 5°·8 in the 60 feet of water), while in the deepest part there was a fall of 2°·4 between 50 and 100 feet, and a further fall of 3° between 100 and 150 feet (equal to 5°·4 in the 100 feet of water). All the observations indicate a range of temperature throughout the entire body of water amounting to 13°·7.

Loch Luichart (see Plate IV.).—Loch Luichart is another large and important loch within the Cromarty firth drainage-basin, second as regards length only to Loch Fannich, though slightly inferior as regards superficial area to Loch Glass. It is a good fishing loch situated amid grand scenery, where Strath Bran bends to the south-east to join Strath Conon (see Fig. 4). Its general trend is north-west and south-east, bending round the base of Sgùrr Mairc-suidhe, and it is broadest at the north-west end, narrowing towards the south-east. It is 5 miles in length, with a maximum width of nearly a mile, the mean width being one-third of a mile. Its waters cover an area of about 1130 acres, or $1\frac{3}{4}$ square miles, and it drains directly an area of about $39\frac{1}{2}$ square miles, but since it receives the outflow from all the lochs described in the preceding pages, its total drainage area is very large—about $149\frac{1}{4}$ square miles, an area eighty-five times greater than the area of the loch. The maximum depth of 164 feet was observed about $1\frac{1}{2}$ miles, or about one-third of the length of the loch, from the north-west end. The volume of water is estimated at 3288 millions of cubic feet, and the mean depth at nearly 67 feet. The loch was surveyed on August 16, 1902, when the elevation of the lake-surface was found to be 249·8 feet above the sea.

The floor of Loch Luichart is irregular, there being three 50-feet basins separated by shallower water. The largest and deepest lies in the wider north-western half of the loch, and is about 2½ miles in length, approaching to within less than 200 yards from that end. The central 50-feet basin is separated from the north-western basin by an interval of half a mile, in which lies the single small island in the loch, and where the depth in the centre at another place is only 5 feet, and is over 1¼ miles in length. Immediately to the south-east of this central basin there is a narrow constriction in the outline of the loch, in which a depth of 16 feet was recorded, succeeded by a slight expansion containing the third 50-feet basin, with a maximum depth of 55 feet and of small extent. The principal 100-feet basin in the north-western part of the loch is nearly 2 miles in length, and encloses the deepest part of the loch. Two small subsidiary 100-feet basins lie within the central 50-feet basin: one based upon an isolated sounding of 100 feet, the other near the south-eastern end having a maximum depth of 115 feet. The 150-feet basin is nearly a mile in length, and is distant three-quarters of a mile from the north-west end of the loch; the maximum depth of 164 feet was recorded near the south-eastern end of the basin. It is curious to note the difference in the outline of this 150-feet basin as compared with the outlines of the 50 and 100-feet basins enclosing it, for, while the shallower contours follow approximately the shore-line, and therefore enclose areas widest towards the north-west and narrowing gradually in the opposite direction, the 150-feet basin is widest towards the south-east and narrows gradually to the north-west as the outline of the loch widens out. At the same time the deep basin approaches nearer to the northern shore at its north-west end, while it approaches nearer to the southern shore at the opposite deeper end, so that at the position of the deepest sounding the slope off the southern shore is much steeper than off the northern shore, as is well brought out in the cross-section C–D on the map. The longitudinal section A–B down the centre of the loch shows the three basins included in the loch, each successively deeper on proceeding towards the north-west end. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 50	482	42·7
50 „ 100	385	34·1
100 „ 150	208	18·4
Over 150	54	4·8
	1129	100·0

Temperature Observations.—The following table gives the results of observations taken in Loch Luichart by Mr. Clark on August 25, 1901, and by the Lake Survey on August 16, 1902:—

FIG. 4.—LOCH LUICHART, LOOKING ACROSS THE HEAD OF THE LAKE.

(*Photo by Mr. David Brigham.*)

Depth in feet.	August 25, 1901 (R. M. Clark).	August 16, 1902, 5 p.m., deepest part of loch in 152 feet.	August 16, 1902, 6 p.m., near N.W. end in 93 feet.
	° Fahr.	° Fahr.	° Fahr.
0	60·6	55·9	56·0
10	60·0	—	—
20	59·6	55·8	—
40	59·1	—	—
50	—	54·8	56·0
60	57·2	—	—
70	—	—	56·0
75	—	51·6	—
80	50·9	—	—
90	—	—	48·5
100	50·5	48·4	—
150	—	48·0	—

The range of temperature shown by the 1901 observations amounts to 10°, while that shown by the 1902 observations amounts to 8°. The temperature of the upper 60 feet of water was higher in 1901 than was observed in 1902, as was also the case at a depth of 100 feet, but a lower reading was recorded at 80 feet in 1901 than at 70 and 75 feet in 1902. The two serials taken in 1902 show the effect of the strong wind which was blowing up the loch at the time of the survey, the maximum temperature observed extending down to a depth of 70 feet near the head of the loch, whereas $1\frac{1}{2}$ miles further down the loch the temperature was always lower, amounting to a difference of 1°·2 at 50 feet and 4°·4 at 70 feet, beyond which depth a much larger fall of temperature was observed towards the head of the loch than was recorded farther down (equal to a fall of 7°·5 in the interval of 20 feet between 70 and 90 feet in the former case, and a fall of 3°·2 in the interval of 25 feet between 75 and 100 feet in the latter case).

Loch Beannachan (see Plate II.).—Loch Beannachan (or Bennachran) is situated at the head of Strath Conon, amid wild moorland scenery. It trends in a west-north-west and east-south-east direction, narrowing towards the eastern end. It is over $1\frac{3}{4}$ miles in length, with a maximum breadth of one-third of a mile, the mean breadth being a quarter of a mile. Its waters cover an area of 267 acres, or nearly half a square mile, and it drains an area seventy-two times greater—an area exceeding 30 square miles. The maximum depth of 176 feet was observed approximately near the centre of the loch. The volume of water is estimated at 819 million cubic feet, and the mean depth at $70\frac{1}{2}$ feet. The loch was surveyed on August 22, 1902, when the elevation of the lake-surface was found to be 465·6 feet above sea-level; when visited by the officers of the Ordnance Survey on June 6, 1870, the elevation was 465·1 feet above the sea.

Loch Beannachan forms a simple basin, the contour-lines following approximately the outline of the loch, but approaching in each case nearer to the western than to the eastern end. There is a large wooded island at the entrance of the inflowing river at the west end, and a small island near the exit of the outflowing river at the opposite end. The slope off-shore is in some places very steep, especially at certain points along the southern shore, and at the position of the deepest sounding the slope is steeper off the southern than off the northern shore, as is shown in the cross section C–D on the map. The longitudinal section A–B shows the gradual slope towards the two ends, with quite a flat-bottomed character in the deeper water, which is also indicated by the larger area between 100 and 150 feet than between 50 and 100 feet, as given in the following table:—

Feet.	Acres.	Per cent.
0 to 50	113	42·3
50 „ 100	67	25·0
100 „ 150	72	27·2
Over 150	15	5·5
	267	100·0

Temperature Observations.—A series of temperatures taken in the deepest part of the loch at 4.15 p.m. on August 22, 1902, gave the following results:—

Surface	55°·0	Fahr.
10 feet	55°·0	„
20 „	54°·8	„
30 „	53°·0	„
40 „	52°·9	„
50 „	52°·0	„
60 „	50°·5	„
75 „	46°·9	„
100 „	46°·1	„
170 „	46°·0	„

This series shows a range of temperature from surface to bottom amounting to 9° Fahr. The upper 20 feet of water was practically of uniform temperature, followed by a fall of 1°·8 between 20 and 30 feet, but the greatest fall observed was one of 3°·6 between 60 and 75 feet.

Loch Achilty (see Plate V.).—Loch Achilty is a small but deep loch in Torrachilty Wood, near Strathpeffer, containing char. In outline it is somewhat elliptical, with the long axis trending north-east and south-west. It is about 1500 yards in length, by 700 yards in maximum breadth, the mean breadth being 450 yards. Its waters cover an area of about 147 acres (or nearly a quarter of a square mile), and it drains an area exceeding 2 square miles. The maximum depth of 119 feet was observed about 250 yards from the western shore. The volume of water is estimated at 332 million cubic feet, and the mean depth at 51¾ feet. The floor of Loch Achilty is irregular. The 10-feet contour follows approximately the outline of the loch, in many places approaching very close to the shore, but the deeper contours are all sinuous in character, and there are two small basins exceeding 100 feet in depth, the larger and deeper towards the western shore, and the smaller, based on a sounding of 112 feet, near the centre of the loch. Deep soundings were recorded in some positions near shore, while in other positions comparatively shallow soundings were taken some distance off shore. A longitudinal section along the axis of maximum depth is shown in section C–D on the map. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.		Acres.		Per cent.
0 to 25	... ...	41	...	28·0
25 „ 50	... ...	28	...	19·2
50 „ 75	... ...	39	...	26·2
75 „ 100	... ...	30	...	20·2
Over 100	... ...	9	...	6·4
		147		100·0

This table shows a smaller area, and therefore an average steeper slope, between 25 and 50 feet, than in the deeper water. The loch was surveyed on August 20 and 21, 1902, when the elevation of the lake-surface was found to be 98·5 feet above the sea, so that the 100-feet contours show approximately the two small portions of the lake-floor which lie below the level of the sea.

Temperature Observations.—In the following table are given the results of three series of temperatures taken in Loch Achilty by Mr. Clark in 1901, along with a series taken in 1902 at the time of the survey:—

Depth in feet.	August 11, 1901 (R. M. Clark).	August 23, 1901 (R. M. Clark).	September 2, 1901 (R. M. Clark).	August 21, 1902 (Lake Survey).
	° Fahr.	° Fahr.	° Fahr.	° Fahr.
0	63·5	61·9	—	58·4
5	—	61·9	—	—
10	62·0	—	—	58·1
20	—	61·5	—	57·6
25	59·4	57·3	—	56·0
30	—	52·0	—	54·9
35	—	46·0	—	50·9
40	46·0	44·0	45·9	48·0
50	—	43·2	43·2	46·0
55	—	42·8	42·8	—
60	—	42·8	42·8	—
70	42·3	—	—	—
100	—	—	—	44·9

These serials indicate a most remarkable range of temperature—a range amounting to 21°·2 from the surface to a depth of 70 feet on August 11, 1901, and 19°·1 from the surface to a depth of 60 feet on

August 23, 1901; the range observed in 1902 was much less, viz. 13°·5 from the surface to a depth of 100 feet. Down to a depth of 25 feet the readings were higher in 1901 than in 1902, but beyond that depth the temperature was lower in 1901 than in 1902. The greatest fall of temperature was observed between the depths of 25 and 40 feet in both seasons, but the decrease of temperature within this interval of 15 feet amounted in 1901 to 13°·3 and 13°·4, while in 1902 it amounted only to 8°. The only observations that may be compared, as regards range of temperature, with these in Loch Achilty, were taken in Loch Monzievaird * in the Tay basin on June 8, 1903, when the range amounted to 20°·6 from the surface to a depth of 36 feet, and when a fall of temperature equal to 1°·5 per foot of depth was observed between 5 and 15 feet. The temperature conditions observed in Loch Achilty (as well as in Loch Monzievaird) may probably be ascribed to (1) the comparatively great depth, (2) the comparatively small drainage area, and (3) the sheltered position, the thickly wooded shores tending to temper the force of the winds blowing across the surface of the water. Mention may here be made also of the large range of temperature observed in the little Loch Dubh † in the nan Uamh basin on July 12, 1902, when the range amounted to 15½° from the surface to a depth of 100 feet; it is possible that under favourable weather conditions, and later in the season, the range of temperature in the waters of Loch Dubh may equal that observed in Loch Achilty.

Loch Garve (see Plate V.).—Loch Garve lies about 5 miles to the west of Strathpeffer, and to the south-west of the mighty Ben Wyvis (3295 feet). It receives the drainage from a large tract of mountainous country lying to the north and north-west. The body of the loch trends in a north-west and south-east direction, and is somewhat elliptical in outline, while the south-eastern end takes a slight bend to the north-east. The loch is over 1½ miles in extreme length, with a maximum breadth of half a mile, the mean breadth being over one-third of a mile. Its waters cover an area of about 380 acres, or over half a square mile, and it drains an area of 114 square miles—an area nearly two hundred times greater than that of the loch. The maximum depth of 105 feet was observed near the centre of the loch, but towards the south-western shore. The volume of water is estimated at 721 million cubic feet, and the mean depth at 43½ feet. The loch forms on the whole a simple basin, with a slight shoaling at the position of the bend in the outline of the loch. The 10-feet and 25-feet contours extend from end to end of the loch, following approximately the form of the shore-line; but the deeper contours are confined to

* See *Geographical Journal*, vol. 23, p. 45; and *Scottish Geographical Magazine*, vol. 20, p. 27, January, 1904.

† See *Geographical Journal*, vol. 25, p. 281, March, 1905.

the wide body of the loch, the 50-feet basin being nearly a mile, and the 100-feet basin nearly a quarter of a mile, in length. Off the central portions of both the north-eastern and south-western shores the slope is moderately steep. The longitudinal section A–B on the map is taken along the axis of maximum depth, and shows the slight deepening of the water near the south-eastern end. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25	131	34·5
25 to 50	104	27·4
50 to 75	72	18·8
75 to 100	64	16·9
Over 100	9	2·4
	380	100·0

From this table it will be seen that nearly two-thirds of the entire lake-floor is covered by less than 50 feet of water. Loch Garve was surveyed on August 15, 1902, when the elevation of the lake-surface was found to be 218·8 feet above the sea; when visited by the Ordnance Survey officers on August 15, 1871, the elevation was 219·6 feet above sea-level.

Temperature Observations.—The following table gives the results of observations made in Loch Garve in 1901 by Mr. Clark, and in 1902 by the Lake Survey:—

Depth in feet.	August 18, 1901 (R. M. Clark).	August 15, 1902.
	° Fahr.	° Fahr.
0	59·3	54·2
5	59·3	—
10	59·3	54·2
15	59·2	—
20	59·2	—
30	—	54·2
40	59·0	—
50	—	54·0
55	55·4	—
60	54·2	—
70	51·0	53·5
85	49·0	—

The 1901 observations show a range exceeding 10°, whereas the 1902 observations show that the temperature was practically uniform from surface to bottom, which may perhaps be ascribed to the influence of the strong winds prevailing at the time of the survey, causing a thorough circulation in the whole body of water.

Loch Kinellan (see Plate V.).—Loch Kinellan is a small shallow loch near Strathpeffer, which was surveyed on August 23, 1902. The elevation of the lake-surface was not determined by levelling, but from the Ordnance Survey contours it is evidently nearly 500 feet above the sea. It trends north-east and south-west, widest in the south-western portion, and with a large wooded island near the centre. Weeds abound along the western and south-western shores, and also between the island and the eastern shore. It is one-third of a mile in length, and its waters cover an area of about 15 acres. Soundings of 10 and 11 feet were taken to the north-east of the island, but the deepest part lies to the south-west, the maximum depth of 16 feet having been observed about midway between the island and the southern shore; 73 per cent. of the lake-floor is covered by less than 10 feet of water. The volume of water is estimated at 5 million cubic feet, and the mean depth at over 7 feet. The temperature of the surface water at 12.30 p.m. on the date of the survey was 58°·7 Fahr., and at a depth of 14 feet 58°·3.

Loch Ussie (see Plate V.).—Loch Ussie (or Usie) is about a mile from Strathpeffer and 3 miles from Dingwall. It is irregular and subcircular in outline, with a maximum diameter from north-east to south-west of nearly a mile. There is one large island with a heronry upon it, and several smaller ones, and weeds are abundant in some of the bays and in the vicinity of the islands. It was surveyed on August 29, 1902, but the elevation above the sea was not determined by levelling; when visited by the Ordnance Survey officers on September 7, 1870, the elevation was 418·9 feet above sea-level. Its waters cover an area of nearly 200 acres, or less than one-third of a square mile, and it drains an area of nearly 4 square miles. The loch is on the whole very shallow, with a deep hole in the north-eastern part of the loch, in which two soundings of 35 feet were taken; except for a neighbouring sounding of 22 feet, the remainder of the lake-floor is covered by less than 20 feet of water, and all the western and southern parts of the loch are less than 10 feet in depth. The volume of water is estimated at 68 million cubic feet, and the mean depth at 8 feet. Only 22 per cent. of the lake-bottom is covered by more than 10 feet of water, and only 2 per cent. by more than 25 feet of water. At 5.15 p.m. on the date of the survey the surface temperature was 59°·3 Fahr., and a reading at 27 feet gave 59°·0.

Loch Glass (see Plate VI.).—Loch Glass is one of the larger and more important lochs within the drainage basin of the Cromarty firth, and it exceeds in depth all the other lochs of the basin. It lies in a mountainous district to the north of Strathpeffer, with Ben Wyvis and other peaks exceeding 3000 feet in height to the south-west, and lesser mountains to west, north, and north-east. It trends in a north-west and south-east direction, but with a slight bend in the outline, causing it to appear somewhat crescent-shaped. It is 4 miles in length, with a maximum width near the centre of two-thirds of a mile, narrowing gradually towards the south-east end, where the river Glass flows out, the mean breadth being nearly half a mile. Its waters cover an area of nearly 2 square miles, and it drains an area exceeding 25 square miles. The maximum depth of 365 feet was observed nearer the north-west than the south-east end, and towards the north-eastern shore. The volume of water is estimated at 8265 millions of cubic feet, and the mean depth at 159 feet. It was surveyed on August 26 and 27, 1902, but the elevation of the lake-surface above the sea was not determined by levelling; when visited by the Ordnance Survey officers on September 1, 1868, the elevation was found to be 712·9 feet above sea-level. Loch Glass forms a simple basin, with very few minor undulations of the lake-floor. The deeper water lies towards the north-west end, and the contour-lines all enclose continuous areas. The 100-feet basin is 2¾ miles in length, approaching close to the north-west end, but distant nearly a mile from the south-east end. The 200-feet basin is nearly 2 miles, and the 300-feet basin over a mile, in length, being distant respectively 1½ and 2 miles from the south-east end. The soundings indicate here and there slight irregularities on the lake-floor, and sometimes in very deep water. One of these gives rise to a curious sinuosity in the 300-feet contour-line off the south-western shore, and the sounding immediately to the south-west of the maximum depth of 365 feet indicates a shoaling of the water to 346 feet, followed by a deepening of the water to 354 feet, which is well brought out in the cross-section C–D on the map. The longitudinal section A–B shows the rapid deepening of the water on proceeding from the north-west end, and the gradual shoaling of the water on approaching the opposite end of the loch. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows :—

Feet.	Acres.	Per cent.
0 to 100	454	38·1
100 „ 200	309	25·8
200 „ 300	269	22·6
Over 300	161	13·5
	1193	100·0

The comparatively large area of the lake-floor covered by more than 300 feet of water indicates the flat-bottomed character of the deeper part of the loch, and this is also shown by the comparatively great width of the 200-feet and 300-feet basins, and is well seen in the cross-section C-D.

Temperature Observations.—An interesting series of temperatures was taken in the deepest part of Loch Glass at 6 p.m. on August 27, 1902, as given in the following table :—

Surface	54°·7 Fahr.
50 "	51°·7 "
100 "	46°·2 "
150 "	43°·5 "
250 "	42°·5 "
350 "	42°·3 "

This series shows a range of temperature from surface to bottom amounting to 12°·4, the greatest fall being one of 5°·5 between 50 and 100 feet. The temperatures taken in Loch Achilty six days earlier gave a higher temperature from the surface down to 30 feet than was observed at the surface of Loch Glass, but a lower temperature at 50 feet and 100 feet, the differences being respectively 5°·7 and 1°·3.

Loch Morie (see Plate VII.).—Loch Morie (or Muilie) lies less than 2 miles to the north of Loch Glass, with the crests of Meall Beag (2121 feet) and Meall Mor (2419 feet) rising between them. It is an important and deep loch, containing trout, but the fishing is preserved. Loch a' Chaoruinn and Loch Magharaidh, which flow into it, could not be sounded for lack of boats. It trends in a north-west and south-east direction, with a slight sinuosity in its outline. It is $2\frac{1}{3}$ miles in length, with a maximum breadth of over half a mile. Its waters cover an area of nearly a square mile, and it receives the drainage from a large tract of the mountainous country to the north-west, the area of which exceeds 35 square miles. The maximum depth of 270 feet was observed in the central part of the loch, but nearer the south-western than the north-eastern shore, as will be seen in the cross-section C–D on the map, which is taken at the position of the deepest sounding. The volume of water is estimated at 3201 millions of cubic feet, and the mean depth at 125 feet. Loch Morie was surveyed on August 28, 1902, when the water-surface was found to be 621·6 feet above the sea; when visited by the Ordnance Survey officers on September 28, 1868, the elevation was 622 feet. The loch forms a simple basin, the contour-lines all enclosing continuous areas. The shallower contours follow approximately the outline of the loch, but the deeper ones bend in their central portions towards the south-western shore. The 100-feet basin is over $1\frac{1}{2}$ miles, and the 200-feet basin is over a mile, in length. The slope of the bottom is in some places very steep—for instance, off the south-western shore towards the north-west end, where a sounding of 75 feet was taken about 60 feet from shore, and one of 124 feet about 120 feet from shore, showing in each case a gradient exceeding 1 in 1. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows :—

Feet.	Acres.	Per cent.
0 to 50	148	25·2
50 " 100	92	15·8
100 " 150	104	17·7
150 " 200	113	19·2
200 " 250	106	18·0
Over 250	24	4·1
	587	100·0

It will be observed that the area between 50 and 100 feet, and to a less extent that between 100 and 150 feet, are smaller than the shallower and deeper zones, indicating an average slope steeper between 50 and 150 feet than elsewhere. The temperature of the surface water was 54°·0 Fahr. on the date of the survey, but serial temperatures could not be attempted on account of the gale that was blowing.

Loch Eye (see Plate VIII.).—Loch Eye is a rather large but very shallow loch, about 3 miles from Tain and a mile from Inver bay, an inlet of the Dornoch firth. It was surveyed on September 26, 1902, when the surface of the water was found to stand 47·8 feet above the sea; on December 24, 1867, the Ordnance Survey officers found the elevation to be 50·7 feet above sea-level, or 3 feet higher than in 1902. The loch is 1¾ miles in length, with a maximum width of nearly two-thirds of a mile, and covers an area of over 210 acres, or one-third of a square mile. The maximum depth is 7 feet, and the mean depth 4 feet, the volume of water being estimated at 37 million cubic feet. The loch is a flat-bottomed shallow basin, 45 per cent. of the lake-floor being covered by more than 5 feet of water. The temperature of the surface water on the date of the survey was 54°·8 Fahr., while a reading at the bottom in 7 feet gave 55°·0.

The particulars regarding the lochs dealt with in this paper are collected together in the table on p. 62 for convenience of reference and comparison.

From this table it will be seen that in the sixteen lochs under consideration, which cover an area of over 11½ square miles, nearly 2200 soundings were taken, or an average of 188 soundings per square mile of surface. The aggregate volume of water contained in the lochs is estimated at nearly 30,000 millions of cubic feet, and the area draining into them is over 366 square miles, or thirty-one and a half times the area of the lochs.

SUMMARY TABLE.

Giving Details concerning the Lochs described in this Paper.

Loch.	Height above sea. Feet.	Number of soundings.	Length in miles.	Breadth in miles. Max.	Breadth in miles. Mean.	Mean breadth per cent. of length.	Depth. Max. Feet.	Depth. Mean Feet.	Depth. Mean per cent. of max.	Ratio of depth to length. Max.	Ratio of depth to length. Mean.	Volume in million cubic feet.	Area in square miles.	Drainage area. Total in square miles.	Drainage area. Ratio to area of loch.
Crann	513·7	26	0·22	0·17	0·10	45·5	17	6·8	39·9	68	171	4	0·02	11·52	576·0
a' Chroisg	508·4	183	3·47	0·42	0·29	8·4	168	73·8	43·9	109	248	2057	1·00	19·15	19·2
South Loch Gown ...	524·4	69	0·55	0·30	0·16	29·1	52	15·9	30·5	56	183	38	0·09	13·10	150·6
North „ „ ...	522·1	72	0·57	0·19	0·13	22·8	17	6·9	40·4	177	438	14	0·07	14·16	191·3
Achanalt	365·1	122	0·84	0·67	0·30	35·7	9	4·5	50·0	493	986	31	0·25	72·63	290·5
a' Chuilinn	360·8	125	1·35	0·31	0·13	9·6	43	10·2	23·8	166	697	50	0·18	74·32	412·9
Fannich	821·9	383	6·92	0·79	0·52	7·5	282	108·8	38·6	130	336	10,920	3·60	35·69	9·9
Luichart	249·8	255	5·05	0·90	0·35	6·9	164	66·8	40·8	163	399	3288	1·76	149·45	84·9
Beannachan	465·6	91	1·85	0·35	0·23	12·4	176	70·4	40·0	55	139	819	0·42	30·12	71·7
Achilty	98·5	131	0·87	0·40	0·26	29·9	119	51·8	43·5	39	89	332	0·23	2·11	9·2
Garve	218·8	137	1·54	0·53	0·39	25·3	105	43·6	41·5	77	186	721	0·59	113·97	193·2
Kinellan	—	37	0·33	0·12	0·07	21·2	16	7·1	44·6	109	244	5	0·02	0·90	45·0
Ussie	418·9 [7/9/70]	109	0·84	0·66	0·37	44·0	35	8·0	22·8	127	556	68	0·31	3·85	12·4
Glass	712·9 [1/9/68]	224	4·03	0·65	0·46	11·4	365	159·1	43·6	58	134	8265	1·86	25·35	13·6
Morie	621·6	126	2·30	0·60	0·40	17·3	270	125·2	46·4	45	97	3201	0·92	35·28	38·3
Eye	47·8	98	1·72	0·62	0·19	11·0	7	4·1	58·6	1294	2215	37	0·33	5·30	16·1
		2188										29,850	11·65	366·33 *	31·5

* The drainage areas of Lochs Crann, a' Chroisg, Gown, Achanalt, a' Chuilinn, and Fannich are included in that of Loch Luichart.

NOTES ON THE GEOLOGY OF THE CONON BASIN.

By B. N. PEACH, LL.D., F.R.S., and J. HORNE, LL.D., F.R.S.

THE rock groups entering into the geological structure of the Conon basin and the area including Strath Glass and Strath Rusdale, north of Ben Wyvis, belong to the crystalline schists and the Old Red Sandstone. A line drawn from a point in Strath Rusdale above Ardross Castle, south-west by Eileneach in Strath Glass, Achterneed station, the Falls of Rogie, and across the Conon to Glen Orrin above Muirtown House, roughly marks the boundary between the metamorphic rocks to the west and the Old Red Sandstone bordering the Cromarty firth. It will thus be seen that the crystalline schists form not only the greater part of the basin, but also the highest and wildest territory.

From the researches of the Geological Survey, extending over the greater portion of the area under description, it would appear that the metamorphic rocks may be arranged in two divisions: (1) a group of acid, basic, and ultrabasic rocks, resembling certain types of Lewisian gneiss of pre-Torridonian age along the western seaboard of Sutherland and Ross; (2) the Moine series, representing altered sediments and including the main subdivisions, (*a*) granulitic quartz-schists or quartz biotite granulites, (*b*) flaky muscovite biotite schists or gneiss frequently garnetiferous, and passing into flaggy mica-schists (pelitic schists).

Though the group of rocks of Lewisian type comprise certain acid granulitic gneisses that closely resemble the quartzose members of the Moine series, yet their dominant feature is the alternation of acid and basic materials in the form of biotite and hornblende gneisses. With these are associated bands of garnet, amphibolite, and hornblende-schist that have been mapped for some distance both in the Fannich mountains, and near Scardroy, in the basin of the Meig. In some areas schists of ultra-basic type appear that represent original masses of peridotite. This group forms isolated areas or inliers in the midst of the Moine series, being regarded as older than the latter, and probably representing the floor or platform on which the members of the Moine series rest. It is significant that different bands of the so-called Lewisian gneisses in the Conon basin are in contact with the crystalline Moine schists of sedimentary origin, and that different subdivisions of the latter overlap the former.

These gneisses of Lewisian type appear at intervals, sometimes forming comparatively narrow zones, and, again, rather broad belts. On the north and west slopes of the Fannich mountains they have been traced for several miles, being there overlain and underlain by the flaky muscovite-biotite schists of the Moine series. Southwards between Strath Bran and the basin of the Meig, near Scardroy, there is a large development of them, where their relations to the Moine schists are well displayed. They likewise appear in Glen Orrin, and southwards towards Glen Strathfarrar, and eastwards near Loch Luichart.

With the exception of certain masses of foliated and unfoliated, intrusive, igneous rocks, the members of the Moine series occupy the rest of the area covered by the crystalline schists. Their lithological characters are comparatively uniform. The two main subdivisions, already indicated, graduate into each other in certain localities, thus forming an intermediate type between the highly quartzose granulitic schists on the one hand, and the flaky muscovite-biotite schists on the other. The members of the Moine series, which have the largest development and the widest distribution, consist of granulitic quartz-schists or quartz-biotite granulites, but the pelitic schists sometimes form the most elevated ground, as, for instance, on Sgùrr Mor

Fannich (3637 feet), the highest of the Fannich mountains.* The boundary-line between the two main subdivisions of the Moine series is highly involved, showing intricate rapid folding, frequently isoclinal, and pointing to intense reduplication of the strata. The most prominent belts of the garnetiferous muscovite-schists have a wide distribution in the basin of the Conon. For example, they appear in the Fannich mountains, and extend south-west by Ben Fionn and Loch Rosque to Moruisg, east of Glen Carron. They likewise appear in Glen Orrin and Glen Meig, and prominent bands have been traced more or less continuously from Strath Bran north-north-west by Aultguish and the hills west of Strath Vaich to Glen Beg and Glen Alladale, in the basin of Strath Carron. Still further east, this characteristic zone has been followed from Ben Wyvis across Strath Glass and Strath Rusdale to the hills near Fearn.

The constant reappearance, throughout the metamorphic area of the Conon basin, of the two main subdivisions of the Moine series suggests the repetition of these zones by folding. Indeed, such is the view adopted by the Geological Survey, and hence the actual thickness of this series may be much more limited than the persistent dip of the strata in one direction would lead us to suppose. The researches of the Survey indicate a probable order of succession in these schists which obtains in the tract between Ben Wyvis and Ben Dearg, and between Garve and the Carron that flows into the Dornoch Firth.

In the flaky muscovite biotite schists, and in the quartzose granulites, bands of garnet amphibolite and hornblende schists occur, which have a wide distribution and are characteristic of certain horizons.

Reference must now be made to the foliated granite, intrusive in the Moine series, which is one of the most interesting features in the geology of the Conon basin. Its boundaries are of prime importance, because the distribution of the boulders supplies valuable evidence regarding the direction of the ice-flow during the glacial period. There are two important masses of these older intrusive rocks. The larger one extends from Carn nan Aigheinn, near the head of Strath Rannoch, north-east by Carn Chuinneag to Cnoc an Liath-bhaid beyond Strath Rusdale, and measures about 12 miles in length and about 5 miles in breadth. The smaller one stretches from the hills above Loch Luichart north-east by Inchbae to Carn More east of Strath Rannoch, being about 5 miles long and less than 3 miles broad. Again, on the north shore of Loch Luichart there are four outcrops of foliated granite, evidently belonging to the same set of intrusions. The Inchbae type of augen-gneiss or granite is well known, with large porphyritic crystals of orthoclase felspar oriented in a definite direction, enclosed in a granulitic ground-mass of quartz, felspar, and micas, together with crystals of garnet and sphene. This coarse porphyritic variety is largely developed in the Carn Chuinneag mass, where it is associated with foliated riebeckite granite or augen gneiss. Frequently the rock is fine grained, and merges into a finely crystalline schist.

Evidence has been obtained that these older granite masses with their basic modifications were intruded into the series of Moine sediments before they were converted into crystalline schists. A well-marked aureole of contact metamorphism accompanied this intrusion, which in places has been obscured by subsequent deformation. But at intervals round the margin the sediments are hornfelsed, and still show their original bedding-planes, while garnets and crystals of andalusite have been developed. It is further apparent that the granite masses and the Moine sediments have been subjected to a common series of dynamic stresses; for the planes

* The quartz-schists contain pebbly bands in places, thus clearly showing their derivative origin.

of schistosity in the granite are parallel to those in the Moine schists; indeed, in certain localities they pass, irrespective of the boundary-line, from the igneous to the altered sedimentary rocks.

On either side of the Sutors of Cromarty, and stretching southwards along the sea-cliff to Fortrose, there is a narrow belt of crystalline schists rising from underneath the Old Red Sandstone. They belong to the group of quartz-biotite granulites, and are associated with bands of amphibolite.

Newer granite masses are also represented in the area, as, for instance, on the hills north of Ardross Castle above Strath Rusdale, and in Glen Orrin west of Fairburn House. They resemble the normal types of the newer granite masses of the Highlands, and were erupted after the Moine schists had assumed their present crystalline character.

The strata of Old Red Sandstone age in the basin of the Cromarty firth are arranged in the form of a great syncline, whose axis runs in a north-north-east and south-south-west direction. The base of the series and the order of succession are admirably displayed on the sea-cliffs at Cromarty, and on the south-east shore of that firth as described long ago by Hugh Miller. The basal conglomerate is there overlain by the well-known fish-band, with calcareous nodules, graduating upwards into the coarse sandstones that form the centre of the basin. On the west side of the firth a similar sequence is observable. The basal conglomerate along the flanks of the hills is usually brought into conjunction with the crystalline schists by a fault, evidently of no great amount, for the unconformity is visible at certain localities. This horizon is surmounted by red sandstones and flagstones, calcareous and bituminous shales, and occasional intercalations of clays with limestone nodules, with fish remains. These are followed by an upper band of conglomerate, which is overlain by the coarse sandstones in the centre of the basin.

Various outliers of Old Red Sandstone, largely composed of conglomerate, and resting unconformably on the highly denuded platform of crystalline schists, occur some miles to the west of the main area of this formation in the Conon basin. Some of these are met with on the plateau between Loch Luichart and Aultguish. By far the largest and most important is that still further north in Strath Vaich, where an extremely coarse conglomerate, composed largely of blocks of the contiguous foliated granite, is found on the crest of Meall a' Ghrianain (2531 feet).

At the base of the sea-cliff formed by the crystalline schists and Old Red Sandstone of the Black Isle and the North Sutor, there are small patches of Oolitic rocks which have only a limited development. They occur on the beach below high-water mark at Eathie and at Port-an-Righ and Cadh-an-Righ near Sandwick. By means of the great fault that traverses the line of the Caledonian canal, and is continued north-east along the shore of the Black Isle, these Secondary strata have been let down against the older rocks.

Regarding the lines of displacement in the Conon basin, one of the most important is that just referred to, which skirts the base of the Black Isle, and is prolonged north-east to Tarbat Ness, whereby this straight feature has been determined. The great fault that traverses Loch Maree and Glen Docherty passes south-east by Ledgown, thence across the watershed by Carn Chaorainn to Loch Beannachan in the basin of the Meig. Another powerful dislocation, nearly at right angles to the course of the Loch Maree fault, has determined the north-north-east direction of the Meig valley between Inbhir-Chaorainn and Milton of Strathconon, and stretches south-west up Glen Chaorainn in the direction of Loch Monar, and north-north-east to the head of Loch Luichart.

During the period of extreme glaciation it would appear that the ice-shed lay some distance to the east of the existing watershed in part of the Conon basin, for boulders of foliated granite or augen gneiss, from one or other of the masses near Inchbae, have been carried westward into the valley of Loch Broom, to Inverlael, and nearly as far as Ullapool. Their distribution in an eastward direction is no less remarkable, for they have been traced as erratics across the Black Isle and the Moray firth to the plain of Moray and the low grounds of Banffshire. The boulder clay of the north part of the Black Isle contains numerous blocks of this well-known rock, which were probably dispersed during the greatest extension of the ice. Such evidence is in harmony with that obtained in the Assynt district, where blocks of the eastern schists have been carried from the plateau of the Moine schists, east of the existing watershed, to higher elevations to the west, formed of Cambrian strata. In view of these facts, it seems probable that during one stage of the glacial period the Conon basin must have been buried under an ice-sheet that overtopped the highest hills, the movement of which was largely independent of the physical features of the region.

During the period of confluent glaciers that ensued, the great mountain groups formed more or less independent centres of dispersion. Indeed, many of the striæ, the disposition of the moraines, and the distribution of the carried blocks furnish evidence relating to this phase of glaciation. In the Fannich mountains—a range running east and west for about 7 miles, and whose main peaks rise above 3000 feet—ice-markings were found on the southern slopes at elevations between 2250 and 2500 feet trending south-south-east. Striæ pointing in a similar direction occur at various points on the ridge between Loch Fannich and Strath Bran, thus showing that at one period the Fannich ice must have crossed that loch into the Bran valley. Again, during this later glaciation, ice crossed the watersheds from Glen Fhiodaig and from Strath Conon into the valley of the Bran, and after uniting with the glaciers from Fannich and the Blackwater, passed eastwards by the Conon valley towards the Black Isle. The striæ, trending about east-south-east, found on the tops of Meall na Speirag and Beinn Liath Beg at elevations of about 2000 feet, on the watershed between the Black Water and the streams flowing into Loch Luichart, clearly show the development of the ice during this period.

Important evidence regarding the transport of materials during the time of the confluent glaciers is furnished by the distribution of boulders of foliated granite and Old Red Sandstone on the slopes of Ben Wyvis. These have been carried from the west or west-north-west, and have been traced up to a height of 2400 feet on Carn Gorm and Little Wyvis, while their upper limit on Ben Wyvis itself is 2300 feet. It is further apparent that the ice moved through the pass between Little Wyvis and An Cabar, and streamed down the valley of Loch Glass north of Ben Wyvis. Still further north in Kildermorie Forest and Strath Rusdale, the direction of the ice-flow was south of east, as proved by the striæ, and the transport of boulders of foliated granite or augen gneiss. From the period of confluent glaciers to the time of their disappearance in the upland glens, the various stages of retrocession are represented by the moraines.

Loch Fannich.—The soundings clearly show that this lake gradually deepens towards the eastern portion, the deepest sounding, 282 feet, being situated about a mile above the outlet. The hill-slopes on both sides of the loch for considerable distances are covered with morainic drift, save near the outlet, where there is a prominent barrier of rock. At the latter point the southern spur of An Coileachan approaches the northern margin of the lake, and is prolonged on the south side in An Cabhar and Carn na Beiste. Along the eastern side of this ridge, the quartzose granulites and muscovite-biotite schists are isoclinally folded on vertical axes striking north and south—that is, at right angles to the course of the lower part of the loch. At the outlet, and for a mile below that point, the Grudie river flows on alluvial deposits, these materials having been largely contributed by side streams, and especially by Allt a' Choin Idir, draining from the north. Beyond the alluvium, at the 800-feet level, the Moine schists are exposed in the bed of the river and on the hill-slopes, and there is here no indication of a preglacial river-channel filled with drift. The surface of Loch Fannich is 822 feet above Ordnance datum, so that the depth of the rock basin below the rocky barrier, visible about a mile beyond the outlet, is 260 feet.

Loch Luichart.—This lake is a true rock basin lying among the crystalline schists, with a barrier formed of these materials at its outlet. Where the stream issues from the loch, it runs through a narrow gorge of rock and over successive waterfalls. In this sheet of water there are three basins, of which the most westerly is the most important, its greatest depth being 164 feet. The surface of the lake is 250 feet above Ordnance datum line. The axis of the upper part of the loch coincides with the strike of the crystalline schists, while that of the lower is obliquely across it. It is interesting to note that the deepest basin has been excavated out of the flaky muscovite-biotite schists, while the shallow part about the middle of the loch north of Creag Mhor corresponds with a belt of highly siliceous Moine schist folded over a core of gneiss of Lewisian type. The head of the lake nearly coincides with the Strath Conon fault already referred to, which crosses the lake in a north-north-east direction, and has there produced considerable brecciation of the strata. Only a small part has been silted up at the western end by the alluvial material brought down by the Bran and the Grudie.

Loch a' Chroisg and Loch Crann.—The former lake is evidently a rock basin, for, though at its outlet it flows over alluvial deposits that mark the site of an old lake, the rocky barrier appears about 2 miles east of Achnasheen, where the 400-feet contour-line crosses the Bran river. The surface of the loch is 508 feet above Ordnance datum, and the deepest sounding is 168 feet, so that the depth of the loch below the rocky barrier beyond Achnasheen is 60 feet. Loch Crann has been separated from Loch a' Chroisg by a cone of alluvium brought down by the streams on both sides of the valley at that point.

Loch Achanalt and Loch a' Chuilinn represent the remains of a lake which once extended for 4 miles up the valley to Dosmuckeran, the level of which has been lowered by the Bran. The materials cut through during this process of denudation consisted of moraine matter, but the river has now reached the solid rock. The terraces round Loch Achanalt and Loch a' Chuilinn rise to a height of 20 feet above the surface of these sheets of water. The deepest sounding in the former is 9 feet, and in the latter 43 feet. While Loch Achanalt is being rapidly silted up by alluvial detritus, Loch a' Chuilinn preserves its character of a rock basin. At its outlet the water flows over an ice-moulded surface of granulitic quartzose schist. The strike of the strata is nearly parallel with the long axis of the loch.

Loch Beannachan.—As already indicated, this lake lies along the line of the powerful fault that has been traced in a south-east direction from Loch Maree and Glen Docherty.

Loch Garve is evidently the remnant of a much larger sheet of water that formerly extended from Little Garve down to the Falls of Rogie—a distance of about 4 miles. The former level of the lake has been lowered by the erosion of the drift deposits and the cutting of the rock gorge at the Falls of Rogie. The surface of the present loch is 220 feet above Ordnance datum line, and the deepest sounding is 105 feet. The 200-feet contour-line crosses the stream at these waterfalls. Hence, on the assumption that the Moine schists and epidiorite sills exposed at the latter locality formed the original rocky barrier of the lake, the depth of water below this level in Loch Garve is still 84 feet.

Loch Achilty.—Though this lake is small, its extreme depth (119 feet) is remarkable. There is no proof that it occupies a rock basin, but it is not improbable that such may partly be the case. Towards the east it has been filled in by the delta gravels of the Black Water, and on the other side by those of the Conon at the time of the formation of the 100-feet beach.

Loch Ussie is a shallow basin, 35 feet in depth, resting in drift; and *Loch Kinellan* appears to be banked by superficial deposits at the west end, while at its eastern margin the bituminous shales of the Old Red Sandstone are exposed. Its greatest depth is only 16 feet.

Loch Morie is obliquely traversed by a line of fault, with a downthrow towards the south-west, that branches westwards in the upper part of the basin. Each branch shifts the outcrop of the zone of altered strata in contact with the mass of foliated granite already referred to. The stream issuing from the lake flows over a rocky barrier, but it is possible that there may have been a former outlet now concealed by drift.

Loch Glass.—Round the north-east margin there are traces of terraces between Culzie Lodge and the foot of the lake. No rocky barrier appears till the Falls of Eillenach are reached, where the stream flows over a mass of conglomerate of Old Red Sandstone age at an elevation of about 680 feet. As the surface of the loch is 713 feet above Ordnance datum line, and the deepest sounding is 365 feet, it follows that the depth of water in Loch Glass below the level of the barrier at the Falls of Eillenach is 332 feet.

Loch Eye lies on the stratified deposits of the 100-feet beach.

NOTES ON THE BIOLOGY OF THE LOCHS IN THE CONON BASIN.

By JAMES MURRAY.

The lochs dealt with in this paper, with the exception of Loch Eye, which will be separately noticed, have the plankton of a very uniform character. The fauna includes only those species which are common to the whole country, and calls for little detailed notice. The most important feature in it is the total absence of all those species of *Diaptomus* (*D. wierzejskii*, *D. laticeps*, *D. laciniatus*), which are common in the districts to the north and south of the Conon valley. This valley, extending nearly across Scotland, forms a line of interruption in the distribution of those species, a line completed towards the west by Lochs Maree, Dhughaill, and Sgamhain, all of similar character. Any slight peculiarity in the fauna will be noted under the name of each loch.

In contradistinction to the absence of western species in the fauna of these lochs, is the occurrence in the flora of several Desmids of the western type. These western Desmids, though less numerous than in districts both to the north and south, are in most of the lochs.

Loch Gown, North and South.—These very shallow basins had an admixture of littoral species in the plankton, and the numerous Desmids included both pelagic and bog species.

Loch a' Chroisg.—The only peculiarities of this loch were the abundance of algæ and of the smaller pelagic animals, such as Rotifera and Protozoa. *Floscularia pelagica*, Rousselet, was abundant.

Loch Achanalt.—Owing to its shallow weedy character, littoral species were more numerous than pelagic ones. A species of *Gammarus* was of a bright slaty blue colour. *Ophridium* was abundant on the weeds.

Loch a' Chuilinn.—Among the Rotifera observed were *Euchlanis lyra*, *E.*

dilatata, and *Piæsoma truncatum*. The Desmid *Staurastrum arctiscon* was frequent.

Loch Fannich.—As in most of our largest lakes, there were skeletons of *Clathrulina elegans* floating in the water. Although this is not a true plankton organism (it lives attached by a stalk to plants), the skeletons have seldom or never been observed during the Lake Survey work except in large lakes, while it has rarely been seen living at the margins of those lakes. The lightness of the skeletons, enabling them to float on fresh water, may serve for the distribution of the species, and small cysts are commonly seen in them. Granting this, their absence from smaller lakes is still unexplained. The only suggestion I can offer is that the lower specific gravity, resulting from the higher temperature of smaller lakes, may prevent the floating of the skeletons, or that the higher temperature may lead to a more rapid decomposition of the material of which they are composed, and so prevent their accumulation in the water.

Loch Garve.—There was nothing peculiar in the plankton, except the apparent absence of Desmids.

Loch Luichart.—In contrast with the neighbouring Loch Garve, Desmids were here abundant, and other algæ were also numerous.

Loch Achilty.—Desmids were numerous, including, among species of the western type, *Staurastrum arctiscon*, and *S. jaculiferum*.

Loch Kinellan.—*Ceratium hirundinella* was very abundant, of a form with long divergent middle horns. There were also observed *Volvox globator*, *Asterionella* with very short rays, a species of *Ceriodaphnia*, and a few larvæ of *Corethra*.

Loch Ussie.—*Ceratium hirundinella*, of the same form as in Loch Kinellan, was the most abundant organism. This was the only loch in the district in which *Latona setifera* was seen.

Lochs Glass and *Morie* have no peculiarity worthy of remark, except the much greater abundance of algæ in Loch Glass.

Loch Eye.—This loch, which is only considered along with the Conon lochs as a matter of convenience, really approximates biologically to the lochs of the Shin basin, and of Sutherland generally. It is remarkable for the abundance of *Diaptomus wierzejskii*, this being the most southern locality on the mainland where the type of the species has been observed by the Lake Survey, though it extends much further south in the Outer Hebrides, where Dr. Scott got it in Barra. The Rotifer *Triarthra longiseta* was also abundant.

NOTES OF A LAND JOURNEY FROM FU-CHAU TO KIU-KIANG.*

By Major A. B. HAMILTON.

In the autumn of 1902, in company with Major the Hon. H. W. Trefusis, Scots Guards, I made the land journey between these two treaty ports. We left Fu-chau on the morning of September 25, in one of the small trading boats that navigate the upper waters of the Min river.

The first 70 miles of the river Min above Fu-chau are probably well known to many readers of the *Journal*. A broad stream picturesquely winding between hills, the lower slopes of these hills being

* Map, p. 128.

fringed with orchards or cultivated in terraces, here and there a group of houses occasionally increasing to the size of a village. It is justly celebrated for its scenery. Numerous large timber-rafts were floating down on its smooth surface, many bearing the Japanese flag, an outward sign of the special interest that Japan is taking in developing the Fu-kien province.

Sui-kau, a straggling village at the head of steam-launch navigation, was reached on the morning of the third day, and Yeng-ping, a prefectorial city, two days later. The city wall was broken and grass-grown, the streets narrow and uneven; it did not look very prosperous.

A few miles above Yeng-ping the river narrowed between shelving rocks, and for a hundred yards rushed down in broken water through a channel barely 20 yards wide. A day or two further on the navigation again became difficult, the stream winding through a labyrinth of low rocks. Tea was being more plentifully grown in this neighbourhood than in any other we saw; but even here it was but sparsely cultivated, rice was still the principal crop. The upper slopes of the hills were a dense mass of undergrowth, principally bamboo-grass. On the sixth day out we reached Kien-ning, another prefectorial town, nothing much to differentiate it from any other except its position. The general aspect of the country as we got further inland grew more open, and the river as a rule flowed silently along in a broad and shallow channel. Just before reaching Kien-yang, however, the river-bed was rocky and contracted, and in the only possible channel the water fell almost perpendicularly for a foot, and the rocks and islands in the stream made tracking very difficult.

Kien-yang stands picturesquely at the junction of a considerable affluent with the river Min. This tributary is spanned by a fine bridge, the abutment and piers of stone and the upper structure of timber on the cantilever principle. It was the only bridge of any size we had seen since we left Fu-chau, and, strange to say, it was particularly clean. We poled and tracked up-stream for an hour after passing Kien-yang with some difficulty, as we continually grounded. So we returned to the city, interviewed the Tao'tai, who received us with the usual ceremony and promised coolies for our outward journey next morning. We were evidently considered very strange beings in our European clothes; wherever we were seen there a crowd quickly gathered to stare at us. They were most inquisitive, but not disrespectful. Our path that morning took us along the right bank of the river, sometimes skirting it closely and sometimes passing across low disintegrated granite hills, and on the following evening we reached the town of Chung-an. On the following day our march was a gradual ascent up a picturesque valley. The road, paved as usual, was very slippery, its granite and porphyry boulders were almost polished by the traffic. We passed a number of pigs; most of them

THE MIN JUST ABOVE SUI KAU.

THE MIN RIVER LEAVING YENG-PING.

were being carried, but some were being driven with grass shoes on their feet. We reached the summit of the pass by midday of October 8. The view in both directions was very fine. An arched gateway with a small fort on one side guarded the highway, as it passed from the province of Fu-kien to that of Kiang-si; but, like all else we saw, it was in ruins.

There was a good deal of traffic on the road: wheelbarrows, the most unsuitable conveyance, one would think, for a stepped pathway, were being laboriously lifted up. Ducks in thousands were being carried over the Bohea hills, to feed in the still irrigated fields of the Fu-kien province. By nightfall we had almost dropped to the plain-level, and were again in the middle of rice-fields. The following afternoon we reached the city of Yuan-shan, and spent a good number of hours in paying and receiving complimentary visits. Next day our path took us through fields and market gardens, with homesteads dotted about. We reached the small town of Ho-ko early in the afternoon. We had reached a navigable waterway, and hired a boat from this town to take us to Sui-fung, six days' journey down-stream.

The river—the Kin-kiang—had a very slight current and a very sinuous course. The country on either bank was undulating, and here and there a sandstone ridge ended in a bluff where it abutted on the river. There was not much cargo-traffic on the river, nor many people to be seen along its banks. The soil, as a rule, was light, and such cultivation as there was was poor.

At Sui-fung we had evidently nearly reached the level of the Poyang lake, for the water was almost still and of a greenish hue. The country on either hand became less and less cultivated, till, shortly after leaving Sui-fung, the channel was simply marked by steep mud-banks some 10 feet high, topped by high grass and reeds that gradually slope downwards into lagoons, with rising ground beyond in the hazy distance. As we journeyed on, the expanse of water increased, and on one of the last spots of dry ground the village of Kong-san appeared to stand on the verge of the lake; but we had not yet come to the lake proper, for a three hours' pull across a sheet of water and we again found ourselves in a maze of tortuous channels between low banks of coarse herbage. It was dark on the evening of October 17 when we turned out of a narrow channel into a much broader one, to find ourselves opposite a considerable town. For some time we were uncertain where we were. We were told that the place was called Kau-man or Poyang, but such a place was not marked on our maps. We subsequently identified it with the town of Jau-chau. We had now reached the edge of the Poyang lake. The following day we again changed our boat, and by nightfall had anchored near the last bit of dry land. Next morning we were under way before three, and, in the uncertain light of a moon veiled by clouds, we

BETWEEN KIEN-YANG AND CHUNG-AN.

ON THE LOWER WESTERN SLOPES OF THE BOHEA HILLS, LOOKING TOWARDS THE FU-KIEN PROVINCE.

headed for the open water. Nothing but a few distant shadows were to be seen, that proved on closer acquaintance to be islands, and towards the far east a very dim line, showing where the mainland lay. The darkness of the early morning hours, and the difficulty of getting a reliable idea of our rate of speed, made the sketching of our course a haphazard one; it went on, however, as usual from hour to hour. We made our course, by the help of slight puffs of wind, from headland to headland. The dull red of the cliffs and the green of the pines and scrub on the hillsides were a relief to the neutral tone of the water. There were hardly any houses and very little cultivation to be seen.

Shortly after noon we entered the land-locked harbour of Tu-chang. That night we anchored a few miles from the city, and next morning headed northward with a favourable wind. The coast-line had quite changed its aspect, and grassy slopes had given way to stretches of driven sand with low rocky peaks standing bare on the skyline. We landed on a low ridge that stood out into the lake, and climbed up its sandy slopes. On reaching the crest-line, the Ku-ling range stood out boldly in front of us on the other side of the lake, here only about 8 miles wide. Looking due north, we thought we saw the junction of the lake and the Yang-tze; this, however, we subsequently found not to be the case. From where we stood the physical geography of the northern end of the lake stood out like a map: open water, peninsulas, islands stretched into the distant haze. We took to our boat again and sailed across the lake to the walled city of Nan-kang, a town that had evidently seen more prosperous days. We were off again early next morning. We had hoped to reach Hu-ku that night, but the weather had changed for the worse, and we had to run ashore some 3 miles from that town. Next morning the wind had gone down a good deal, but it was still rather unpleasant in a small boat. Rounding the north-east corner of the lake, we suddenly came upon the walled town of Hu-ku, and had reached the Yang-tze. There was a marked contrast between the clear and greenish-coloured water we had been travelling on and the light chocolate flood of the river. Another day's tracking up-stream, and a very dirty night of rain and wind that lashed the Yang-tze into muddy waves, and we had reached Kiu-kiang.

The route-sketch was undertaken to give additional interest to the journeys; it has no pretensions whatever of being a map. Putting the instruments on one side, the conditions under which it was drawn, sometimes by moonlight, sometimes almost in the dark, often on the unsteady platform of a rocking boat, effectually prevented this. Its only merit is that it assists in illustrating a highway that, as far as I am aware, has not been described even with this accuracy before.

ADMIRALTY SURVEYS DURING THE YEAR 1904.

By Captain A. MOSTYN FIELD, R.N., F.R.S., Hydrographer.

UNDER the orders of the Lords Commissioners of the Admiralty, eight of His Majesty's vessels, with three small hired steam-vessels, manned by an aggregate of 76 officers and 740 men, have been employed on hydrographical surveys on various stations at home and abroad. The following is a brief summary of the work accomplished, as detailed in the report prepared for presentation to Parliament:—

Reports of 482 rocks and shoals which were dangerous to navigation have been received at the Hydrographic Department, and were notified to the public through Notices to Mariners; 1139 miles of coast have been charted, and an area of 3993 square miles has been sounded.

Around *Great Britain* various surveys were made.

In *English* waters, at Portsmouth and Plymouth, much close resurveying was done in areas which had been recently dredged. At Dover some careful observations of the tidal streams were obtained. Various re-examinations in the ever-changing Thames estuary were carried out; the Shingles patch was found to have the same depth over it, namely 9 feet, as in 1902, with signs of extension towards the north-west. Further experiments were continued with the manometer, a pneumatic tide apparatus, which it is hoped may eventually lead to the production of a reliable self-recording instrument.

Torbay was resurveyed, and also the western channels of the Scilly Isles with their approaches.

In *Irish* waters, the survey of Youghal harbour, commenced last year, was resumed and completed.

In *Scottish* waters, Inverie bay, Loch Nevis, Ballachulish bay, Loch Linnhe, and Rothesay bay were surveyed. The surveys of Loch Kishorn and the entrance of Loch Carron were partly made, and will be completed, it is anticipated, next year; a survey of the sound of Mull was begun, and Inver Scadle bay, Loch Aber, was examined. The weather in the summer of 1904 for Scotland was exceptionally fine.

In *Newfoundland* waters, an exhaustive and unsuccessful search was made over an area of 350 square miles to ascertain the position of a reported 10-fathom bank, which was searched for in 1892 without success. The survey of the south-eastern portion of the Bay of Exploits was resumed.

In *British Columbian* waters, the survey of the area lying between Ballinac islands and Active pass was finished. Nanaimo harbour and Departure bay were resurveyed. A large-scale plan of Nanaimo harbour, commenced last year, was finished. Plans were also made of Oyster harbour, Active pass, and Dodds and False narrows. A rock reported to exist at the northern entrance to Baynes sound was searched for without success.

On the *West Coast of Africa*, surveys were made of Opobo river bar and approaches, with a sketch-survey of the river between Opobo and Egwanga, the new Government station; of the Brass river and approaches; and of the Nun river entrance and approaches as far as Akassa. At the river Gambia entrance positions of buoys were verified.

In the *Mediterranean*, the Gulf of Corinth as far north as Vurko bay, embracing the approaches to Dragamesti bay, was surveyed, and a large-scale plan was made of Plateali bay (Platea).

In the *China seas* two vessels were at work. The survey of Mirs bay, near

Hong Kong, was resumed at Double Haven and Starling inlet, and was completed. The survey of Port Shelter, which is between Hong Kong and Mirs bay, was begun. The survey of Amoy harbour on a large scale, begun last year, was finished, and of the approaches to Amoy, including Quemoy port. The survey of the British sphere of influence on the Shantung coast was resumed and finished, and a plan was made of Wangkia bay.

In Borneo a survey was made of Gaya and its approaches, with plans of Jesselton (now the terminus of the railway) and of Tega channel.

In *Australasian* waters, on the east coast of North island, New Zealand, 61 miles of coast-line has been surveyed, from East cape to Gable-end foreland, and soundings were obtained over an area of 802 square miles in the vicinity of this coast; 91 miles of coast has been surveyed in Hauraki gulf, from Tiri Tiri Matangi to Tawharanui point, and soundings were obtained over an area of 228 square miles.

In South island, New Zealand, the approaches to Westport and Buller bay, and the approaches to Awarua or Bluff harbour, were surveyed, a large-scale plan being made of the Bluff.

In *Indian* waters, the surveying ship maintained by the Government continued the survey of the Arakan coast, finishing that portion included between Asirgarh shoal and the south point of Western Baronga; Hinzé basin and a portion of the coast of Andaman island remaining from last year's work being surveyed, also Mayu river and a plan of Akyab.

The approaches to the proposed ship canal through Rameswaram island were surveyed, while the surveys of Stewart island, in the Andamans, and various harbours in the Persian gulf are in progress.

During 1904 the Hydrographic Department has published 113 charts and plans, and 60 new plans have been added to the existing plates. The number of charts printed to meet demands has, during the year, amounted to 661,590.

REVIEWS.

AFRICA.

Geology of Tunis.

'Étude géologique de la Tunisie Centrale.' By L. Pervinquière. Paris: F. R. de Rudeval. 1903.

This elaborate monograph is a solid contribution to the geology of North Africa, a subject which is being enthusiastically studied by French geologists, and has, in consequence, a rapidly growing literature. It is supplementary to a description of the physical geography of the district by the same author, published a few years ago, and contains a useful map on the scale of 1 : 200,000, and a full bibliography. The rocks are principally Cretaceous and Tertiary, but older beds are known also (Trias and Jurassic), and there are igneous masses of unknown age. Elaborate details are given of the exposures examined, with lists of the fossils collected; and, as very little was previously known of considerable parts of the district, the book is likely to be for some time the principal authority on the subject of which it treats.

POLAR REGIONS.

RECENT LITERATURE OF THE ANTARCTIC.

'Vers la Terre polaire australe.' Par E. Pariset. Extrait des Mémoires de l'Académie de Lyon. Lyon: A. Rey. 1904. Pp. 134.

'The Belgian Expedition under the Command of A. de Gerlache de Gomery.' Summary Report of the Voyage of the *Belgica* in 1897, 1898, 1899. Brussels: Hayez. 1904. Pp. 70.

'Au pays des Manchots.' Recit du voyage de la *Belgica* par Georges Lecointe. Bruxelles: Oscar Schepens & Cie. 1904. Pp. 368.

'Zum Kontinent des Eisigen Südens von Erich von Drygalski. Deutsche Südpolar-expedition.' Fahrten und Forschungen des Gauss 1901–1903. Berlin: Georg Reimer. 1904.

'*Antarctic*. Zwei Jahre in Schnee und Eis am Südpol.' Von Dr. Otto Nordenskjöld, J. Gunnar Andersson, C. A. Larsen, und C. Skottsberg. Nach dem Schwedishen Original ins Deutsche übertragen von Mathilde Mann. Berlin: Dietrich Reimer (Ernst Vohsen). 1904.

'*Antarctica*, or Two Years amongst the Ice of the South Pole.' By Dr. N. Otto G. Nordenskjöld and Dr. Joh. Gunnar Andersson. London: Hurst and Blackett, Limited. 1905.

The volume of Antarctic literature has been expanding rapidly during the few years of the present century, and for a time the increase promises to continue. So much that is new has to be recorded and described that there may be a tendency to overlook the earlier efforts in the light of the splendid achievements of recent expeditions. In this article we propose to notice a batch of books which have little in common save their centre of interest in the region surrounding the south pole. Their variety promises well for the further multiplication of works on the same subject, rousing new interests and avoiding the monotony which casts a gloom over many works of travel.

In his modest little summary of the history of Antarctic exploration, M. Pariset makes use mainly of the admirable work of M. Rainaud, 'Le Continent australe, hypothèses et découvertes,' the no less able treatise of Dr. Fricker, entitled 'Antarktis,' Mr. Balch's invaluable 'Antarctica,' and the 'Antarctic Manual.' With such guides he has been able to present an excellent epitome of the early speculations and the later voyages of discovery. The record is carried down to the return of the *Discovery* and the *Scotia*. Though accurate as a rule, there are some blunders, as in the statement with regard to Mr. Borchgrevink, 'Il obtint le patronage de sir George Newnes, et par cet influent lord le concours de la puissante Société royale de géographie de Londres." It is an error, also, to say that Sir James Ross's expedition of 1843 was under the patronage of the Royal Geographical Society. M. Pariset has permitted a good many misprints of names of persons and places to escape his attention; we have noted nineteen of these, ranging from *Hobbart-Town* to *Mossmannn*.

The other books are narratives of exploration. Two concern the Belgian expedition, of which the first is an excellent English translation of the commander's summary report, which must henceforth be the standard narrative of the events in our language. It contains full particulars of the Commission for working up the results, and the names of the authors of the reports. The second is yet another personal record of the voyage, and one by no means inferior in interest to those of M. de Gerlache and Dr. Cook, for it is written by M. Georges Lecointe, the second in command of the expedition. The book is capital reading, the author displaying a happy krack of discovering a silver lining of humour in the blackest clouds of discomfort and danger which overshadowed the expedition. The one drawback is that his too frequent use of nautical terms makes the perusal something of a burden to those who, like Kipling's engineer-hero MacAndrews, have not been privileged to—

"... sail
With such as call a snifter-rod *Ross* ... French for nightingale."

No account of the cruise of the *Belgica* we have read has brought home to us so fully as this the tragic elements in the attempt to fit out an expedition on the miserable pittance scraped together with such an infinity of pains by de Gerlache and his companions. Official polar expeditions have, as a matter of tradition, double pay secured for all officers and sailors, and the pick of a navy to man the ship, the best instruments that money can buy, and a scientific staff—when one is carried—comfortably housed and paid at least as much as they might reasonably expect to earn by scientific work on shore. But on the *Belgica* the whole equipment was full of humiliations for the officers in charge. The miserable engine was always breaking down, the anchor-chains jammed at the critical moment, the crew were in large part the scum of several nations, seldom respectful, often mutinous, and ultimately half mad as a result of the inadequate food and poor accommodation. The scientific staff were not only unpaid, but themselves assisted the finances of the expedition as far as their slender resources allowed. That the result was not ignominious failure is surprising; that it was a conspicuous success exalts the efforts of those on board who had the interests of the expedition at heart to a high level of heroism. Lecointe's own work, suffering as he did continually from sea-sickness, was prodigious. Arçtowski and Racovitza collected and in large part discussed a vast amount of entirely new scientific material. The cheery enthusiasm of Cook and his medical skill kept the whole party together, though at times, after the death of Danco, things looked very black indeed. Everything was due to the unfaltering determination of de Gerlache to lead a south polar expedition, even if we read between the lines that the commander at times lacked that firmness and decision which are essential to a perfectly successful leader. No praise can be too great and no honours too high for those men who persevered and triumphed in the face of the indifference of their country, and in spite of every difficulty which the ingenuity of the Adversary could have piled upon Job himself.

The popular narratives of the German and Swedish Antarctic expeditions by their respective leaders appeared with a most creditable promptitude, which deserved the recognition of an earlier review. Both Prof. von Drygalski and Dr. Otto Nordenskjöld have personally addressed the Royal Geographical Society, and the authoritative narratives of their experiences have duly appeared in these pages, accompanied by a fine selection of their photographs. It is, consequently, unnecessary to summarize the incidents of the voyages and the winterings in the present article, but we must give a meed of praise to the books.

Prompt publication of reports of scientific work has characterized the expedition of the *Gauss* from the commencement, and an account of each section of the voyage was published by the German Oceanographical and Geographical Institutes in Berlin as soon as it was received. Prof. von Drygalski's book, however, contains a great deal that is both new and interesting; though its bulk has wisely been restricted to a single volume, its page has an ample size doing full justice to the photographs with which it is adorned.

The book shows that the voyage of the *Gauss* aimed at much more than polar exploration. It was a small *Challenger* expedition in a ship specially adapted for ice-navigation, which wintered in the ice. The first place must be given to the importance of the oceanographical work on the voyages out and home. By the cruises of the *Valdivia* and the *Gauss* the leading place in oceanography seems to be passing from Great Britain to Germany, though the fine work carried out on the *Scotia* shows that we have not yet taken the second place. Almost one-half of Prof. von Drygalski's book is devoted to the description of voyages and work in temperate and tropical seas, with excursions on land at various points. The other half describes the discovery of new land between the discoveries of Biscoe and Wilkes, the wintering in the frozen sea off the previously unknown coast, and various expeditions by sledge and on foot to the inland ice and the interesting nunatak of the Gaussberg. The ice-structure was studied with the care and intelligence that the brilliant work of the leader in earlier years in Greenland led one to expect.

It was extremely unfortunate that the condition of the ice made it impossible to trace the new land, Kaiser Wilhelm II. Land, either towards the east or the west. To the east high land was seen apparently not more than 60 miles from the ship, but it was not visited, nor is it even named; the map merely designates it "High Land." Drygalski mentions in a footnote that, though he gives the land no name, it is still questionable whether it is Wilkes's Termination Land or not. It certainly is not in the position to which Wilkes assigns it, though Wilkes never professed to fix that position definitely; but though the *Challenger* and the *Gauss* herself showed that the Termination Land of the maps was non-existent, the new "high land" lies on the same bearing, and in the Antarctic it is well known that amazing variations in visibility often occur. The probability seems to be that Termination Land does exist probably not further from the position suggested by Wilkes than is Alexander Land as seen by Gerlache from the position laid down by Bellingshausen.

Dr. Nordenskjöld's book has reached us in the form of two translations—the English in one volume, the German in two. Externally the German edition is the more attractive, the design on the cover being particularly neat; but the English version fails in no other respect. The book consists of the narratives of the leader and of his companions, Dr. Gunnar Andersson, Captain Larsen, and Mr. Skottsberg, whose names appear on the title-page. The novelty is fully justified by the freshness with which the story is told of each of the three parties into which the expedition was involuntarily divided during the second winter on the southern land. The dramatic episodes of the loss of the *Antarctic*, the successive meetings of Nordenskjöld with Andersson on the ice, with the Argentine party sent in search of him, and lastly with Larsen, are turned to good account. A feature of the book is the intermingling of very clever sketches—some striking pieces of colour amongst them—with the numerous photographs. The English translation is so well done that one looks for the translator's name as in the German edition, but it is not there.

The map of the great peninsula of Antarctic land has been enriched by several new names, but several changes of name are also shown, which we consider ought to be arranged, when necessary, by some international body, such as the International Geographical Congress, because it is very awkward to have different names in different works of reference, and there is at present no authority to turn to when a doubtful point of nomenclature has to be settled. The coast of Oscar Land will find work for several future explorers, and as it was laid down by Nordenskjöld from a distance, it may have surprises in store for the first man who actually lands upon it and explores its bays to discover if haply they may be fjords or even channels leading to the western ocean.

Indeed, the feeling left on the mind by the perusal of the narratives of all the recent Antarctic expeditions is that they are but the introduction to the systematic exploration of the south polar area, to which their efforts have directed attention. The problem is in no way settled, the most interesting of the old questions have not yet been answered; a whole host of new questions have been proposed, and the great bulk of the Antarctic Region still lies upon the map as blank a blot as ever, still holding out the old invitation which cannot long be disregarded—"Come and see." H. R. M.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Economic Geography.

'Natur und Arbeit.' By Dr. Alwin Oppel. Leipzig and Vienna: Bibliographisches Institut. 1904.

'Grundriss der Handelsgeographie.' By Dr. Max Eckert. Leipzig: G. J. Göschen'sche Verlagshandlung. 1905.

Dr. Oppel's large work, extending to upwards of eight hundred large 8vo pages, is invaluable both on account of the abundance of matter in the text and its great wealth in illustrations, including maps. The nature of the work will be best gathered from an account of its contents. It is divided first into two great sections, one dealing with the conditions and history of economic activity (*Wirtschaft*), the other, comprising two-thirds of the entire work, dealing with the economic activity of the present time. The subdivisions of the section on the conditions of economic activity treat respectively of the Earth's crust, water, air, the vegetable world, and man. The historical section brings us down from the most primitive times to the eighteenth century. The section on the economic activity of the present time is divided into seven sub-sections, treating respectively of general conditions (forms of economic organization, the relation of economic activity to the character of the surface, the influence of race, the science of economics, the state in relation to economic activity, colonial systems, capitalism, machinery, etc.), the production of minerals, that of commodities in the raw state of vegetable origin, similar commodities of animal origin, handicrafts and manufacturing industry, trade, and means of communication and transport.

From this account it will be observed that the plan is not geographical. There is no regional geography, although notes on geographical distribution are given under every heading that makes such information appropriate. Under all the headings the author shows remarkable power in briefly summarizing the most essential facts; the illustrations are well selected, and the numerous coloured maps, some of which must have involved great labour to compile, very instructive. Some of these maps might be criticized in details, but neither in the text nor in the maps has any important error fallen under the notice of the present reviewer.

When there is so much to say in praise of the work, it will be understood that any indication of deficiencies is made solely in the hope of seeing improvements in a later edition. It is to be regretted that the history of economic development is not continued from a general point of view beyond the end of the eighteenth century. If that had been done we should probably have had more than the mere incidental references to water-power, which are all that is to be found on that head at present. Probably, too, the importance of improvements in artificial lighting in relation to economical development would have been appreciated and duly set forth. As it is, we have only an incidental mention of electric lighting under electricity (somewhat strangely introduced as one of the subordinate divisions under the head of the atmosphere in the first part), and a similar incidental mention of incandescent mantles under zirconium and thorium. The continuation of the historical point of view would probably also have suggested to the author the desirability of giving information as to the manning of ships at different periods—of sailers in the old fighting days as compared with the present day when ocean-routes are as safe as those on land; of the large sailers of the present day as compared with cargo-steamers of corresponding tonnage and with ocean flyers.

In Eckert's work, as might be expected from the title, the geographical point of view predominates. It is in two volumes, the second of which is entirely devoted to regional geography, and is more than twice the size of the first, which treats of the geography of production and exchange under general heads, or with reference to commodities. The arrangement is thus similar to that adopted in several other well-known text-books on commercial geography. Among the specially good features of the first volume may be mentioned, in addition to sundry comparative statistical tables, the sections on the carrying capacity of various means of transport by land and water (pp. 143–4), the similar statement on p. 146 with regard to the rate of transport (though in this statement river-steamers and canal barges are unfortunately not included), the list of fastest trains, that of the fastest steamers on great ocean waters, the statement of time taken in 1903 on the trans-continental railway journeys—Lisbon-Paris-Berlin-Dalni and New York-San Francisco (pp. 147–9), the table of European time-distances from Berlin (pp. 153–7), the section on money and the ratio of exchange of gold and silver at different dates (pp. 169–71), and the sketch of the stages in the commercial history of the world (pp. 172–4). In this last section it is rightly pointed out that a great distinguishing feature of the commerce of the past and present lies in the fact that it is only in modern times that bulky goods have entered into the commerce carried on between remote parts of the world, but hardly enough stress is laid on the fact that this is specially a feature of the railway period. Pages 193–7 contain some just and suggestive estimates of the future trade-routes of the world.

A notable feature of the volume on regional geography is the inclusion of the colonial possessions of different countries under the countries to which they belong, which from a geographical point of view is very unsatisfactory. The result is that for all that properly belongs to regional geography, in the case of the colonies, one must refer to the brief notices of the continents to which they belong, the sections on the colonies furnishing mere details without geographical nexus. Among the British possessions, Nigeria, British East Africa, and Uganda get just as much notice as Christmas, Fanning, and Palmyra islands; that is, a mere mention. Egypt has two pages devoted to it, under Turkey; but even the joint dominion of Britain and Egypt in the Egyptian Sudan has not secured for it a mention in the list of British possessions. In both volumes, but especially in the second, there is an excessive heaping up of detail in a form in which it is of little or no use, or at least in one more proper to a statistical annual than a geographical text-book, together with an absence of insistence on important and significant details. Both volumes, moreover, contain many details of greater or less importance that await correction in a future edition. Each volume is provided with an index, in which, however, no attempt is made to distinguish the more important references. A bibliography of eleven pages is appended to the first volume.

G. G. C.

GENERAL.

More Geographical Text-books.

'Dodge's Elementary Geography;' 'Dodge's Advanced Geography.' Chicago, New York, London: Rand, McNally & Co. 1904. Small 4to. Pp. 231, 333, xix.

Prof. Dodge, of the Teachers' College, Columbia University, New York, has planned a new series of geographical books for American schools. Each work consists of two parts—I. Elementary, containing (1) Home Geography and World Relations, (2) Elements of Continental Geography; and II. Advanced, consisting of (1) The Principles of Geography, and (2) Comparative Geography of the Continents. This distribution of the subject-matter, as well as the method of presentation, from consequences to causes in the elementary book, and from causes to consequences in the advanced book, are to be commended. The large number of views, usually well chosen, maps of varying value, and statistical diagrams, add to the value of the books. The General parts of the work and the United States are the sections which will be read with most interest by teachers in this country, and these they will find instructive and accurate. The other parts are not so well done. The author has been particularly unfortunate in the case of the illustrations of the British Isles. In the elementary book Derwentwater is shown as in the "Scotch lake country," while two spinning-wheel scenes, an old-fashioned farmhouse kitchen, and peat-cutting—without which, of course, no American collection of photographs of the old country would be complete—are selected, along with views of sheep and cattle, to represent British industries. In the advanced book a view of "Glenariff, Scotland, where the highlands and lowlands meet," must puzzle every reader who notices the typical valley cut in a plateau, in this case that of Antrim. The picture called "Looking over the English lowlands called 'downs'"—an unfortunate phrase—is an equally unfortunate selection, for the downs are nearly invisible. "Lima Glen, Scotland," is an American name unknown here, and Keswick is placed in Scotland. There is the common misuse of English for British. There are a number of statements to which exception might be taken, such as "France is not a great commercial nation" (its foreign trade is almost as great as that of the United States, which we presume the author would not describe in this way), "the Orange River colony is famous for its mines," "the diamond-mines here are the greatest in the world," "the Southern Alps rise to an altitude of 7000 feet," and a number of others. With a very thorough revision in a second edition, the value of these two volumes will be greatly enhanced.

Greater Britain.

'A Historical Geography of the British Empire.' By Hereford B. George. London: Methuen & Co. 1904. *Price* 3*s*. 6*d*.

It is not without significance that a third of this volume deals mainly with the British Islands and the geographical conditions, from the earliest times, which have determined their development. It is worth reminding ourselves that the size and picturesqueness of the geographical phenomena of a region are not always an index to its real importance in the present organization of the world. So there is good ground for devoting considerable space to the conditions which affected the political unity of England before the Conquest, while Scotland and Ireland receive a shorter but similar treatment. In modern times the economic rather than the political aspects of the question are necessarily emphasized. The real difficulty, after the early period, is to attain a consistent picture of general development in the light of geographical principles. There is much purely historical matter which has no very definite geographical basis; and some of the geography would, perhaps, be more in place in a modern descriptive text-book. But, on the whole, a fairly definite impression can be gathered of the growth of the British Isles in the light of geography. The same can scarcely be said of the sections dealing with the Empire at large. We have first the "stepping stones," mainly the islands; then the daughter nations, Canada and Australia; then the dependencies, India and the West Indies; then the protectorates, and finally the

British dominions in Africa. There must necessarily be a certain amount of cross-classification in any attempt to deal systematically with the whole empire; but by the above method the continuous and connected growth of a complicated organism is not made clear; the connection is often implied, but careful search is needed for its elucidation. The impression produced is that of an encyclopædia of historical and geographical facts, which the ordinary reader is more likely to use for casual reference than for continuous study. A. J. S.

A Geographical Calendar.

'Geographen-Kalender.' In Verbindung mit vielen Fachgenossen herausgegeben von Dr. Hermann Haack. Dritter Jahrgang, 1905–1906. Gotha: Perthes. 1905. *Maps and Portrait. Price* 3.50*m.*

The third issue of this useful handbook shows some further developments, bringing still nearer realization the aim of its originators to make it an indispensable work of reference for geographers throughout the world. Such it may certainly be considered, for all who have once made use of the information supplied by it in so handy a form would at once find themselves at a loss were the help thus afforded them withdrawn. Particularly useful, even in the first issue of the 'Kalender,' was the comprehensive list of geographers of all countries, with addresses, giving as it does information to be found in no similar publication. In the present issue this list has been largely extended, and includes not only the names of all who have in any way contributed to the progress of modern geography, but of many representatives of kindred sciences—geology, astronomy, economics, etc. A change of some importance has been made in the section treating of the literature of geography, which now takes the form of a simple bibliography rather than a review of the literature of the year. In this way it has been possible to make it far more comprehensive than before, the number of separate titles inserted being well over two thousand. The sections on exploration and events of wide political or international importance—both this time by Prof. Langhans—continue to give a concise but comprehensive survey of the events of most importance in these directions, being illustrated besides by an unusual number of maps. The first section, entitled "Kalendarium," adds a number of useful tables to those contained in former issues, including tables for the mutual conversion of metric, English, and Russian measures of length. The portrait now given is that of Prof. Reclus.

THE MONTHLY RECORD.

EUROPE.

Autumn Rainfall and Yield of Wheat in England.—Dr. W. N. Shaw, secretary of the Meteorological Council, has pointed out the close relation which seems to exist between the amount of rainfall in the autumn months (*i.e.* approximately September, October, and November) and the yield of wheat in England during the following summer. A preliminary note on the subject, which he is further investigating, was given in the *Proceedings of the Royal Society* for April 10, 1905. An examination of the returns of rainfall and yield of wheat since 1884 for the "Principal Wheat-producing Districts" shows that the dryness of autumn is the dominant element in the determination of the yield of wheat of the following year. So much is this the case, that Dr. Shaw has been able to work out an equation between the amount of autumn rainfall in inches and the yield of wheat in bushels, and finds that, by the use of this equation, the yield could have been computed within 2 bushels for fourteen years out of the twenty-one; the extreme variation during the whole period being as much as 9 bushels. There are, of course, various years in which the agreement is upset by specially unfavourable conditions in summer, and this suggests the inquiry whether the connection traced is an immediate or, in part at least, a secondary one, *i.e.* whether it may be that a dry autumn is more likely than not to be followed by beneficial weather conditions during the following year. It would thus be of interest to know the summer conditions in the case of years in which the closest agreement between the yield of wheat and the dryness of the preceding autumn has been traced.

Lower Brittany.—In an article in the *Annales de Géographie* (No. 73, xiv. année) devoted to the evolution of rural life in Lower Brittany, and marked equally by human interest and scientific perspicacity, Prof. Camille Vallaux recounts and estimates the geographical factors which have contributed to the formation of the character of the people of that region. Morally, Brittany still counts in France as the unique survival of an age long outlived elsewhere. This archaic stamp is due, first and foremost, to the geographical seclusion of the district. Its isolation on three sides from the rest of the continent was much more accentuated in the time of sailing vessels. Despite the number of anchorages offered by the coasts, the navigation of the encircling sea was extremely difficult for coasters. Not to speak of squalls, the tidal currents run perpendicularly to the entrance of the bays, estuaries, etc., at the rate of 2 to 3 knots on the south, 5 to 7 on the west, and 2 to 6 on the north, and in the midst of dangers caused by the crumbling away of the granitic rocks of Léon and Cornouailles (continental Cornwall). Internally, again, the land is parcelled out into compartments markedly separate from a geographical point of view. Their short course to the sea and the impermeability of the rocks they traverse give to the streams a supra-torrential character, witnessed by their fall, in most cases, of 7 to 17 per 1000. Add the excessive humidity of the climate, due to an almost equal distribution of rain among the seasons, the very numerous springs and bogs, and it will be understood how, in this land, water is as much an obstacle as an aid to rural cultivation. Even to this dry denuded plateaux, eroded crests, and bogs oppose serious difficulties to agriculture. The zone between valley and crest would seem the only land available, and this had to be cleared of the forest covering it. The former extent of forest is approximately determined by documents, eked out by study of the region itself. Save in a few protected spots, the violence of the brine-charged west winds allow no footing to forest at less than 3 to 6 miles inland. Inland, again, the Arrée and Noire mountains, of sandstone and quartzite respectively, are unfavourable to natural forest. But apart from shore-land and mountain tops, forest pretty well covered the whole country, and was particularly thick in the legendary Brocéliande, which, as indicated by local names, extended west to the base of the Arrée. The extent of forest in Cornouailles is also fairly established. There was thus a very extensive forest belt, between crests and inundated valleys, amenable to culture. The lands easiest of subjugation, and so first attacked, include the few alluvial plains along the coast (Plounéour-Trez and Lesneven), the littoral granites of relatively rapid superficial decomposition (coast border of Léon and Cornouailles), and the schists of the Châteaulin basin. In these regions are the fewest remains of forest and landes. The inland granites, on the other hand, still bear respectable forests (Duault, Loudéac, Beffou, Coat an Noz, Coatlo'ch). With the exception of those of Plouray and Lanvaux all the landes, again, in Lower Brittany at least, belong to the region of quartz sandstone. Traces of ancient enclosures on the most arid spots of the Arrée and Noire mountains tell the tale of unscientific experiments at cultivation. The surplus of water with which the peasant had to contend was aggravated by the numerous watermills he set up on the lowest streams. Down to this day the little mills are a characteristic feature of the Armoric landscape, and are but slowly giving way to the great *minoteries*. The paper shows vividly how the geographical partition of the soil into narrow separate belts induced a corresponding social and economic partition into small groups with little or no intercommunication. A graphic picture is given of the lonely village and still lonelier farm. The remark of Cambry (1794) is cited, how in passing from Léon to Cornouailles, thence to Trégorrois, thence to Vannetais, the traveller in each passage has the impression of passing into a new world in respect of language, costume, habits, social instincts, and human physique. The interest of the paper is fully sustained, as it traces the extent to which this so long isolated corner of France has been and is being transformed by absorption into the actual life of to-day.

Changes in the Hydrography of the Mouth of the Weser.—There are few districts in which the coast-changes which have taken place within historical times can be so well studied as in the German portion of the North sea border, where the low-lying coastal flats are liable to the constant encroachments of the waves and tidal currents. The latest study in detail of such changes has been made by Dr. F. Schucht, of Berlin, in the *Mitteilungen* of the Vienna Geographical Society for March last (vol. 48, No. 3). The changes to which the mouth of the Weser has been subject since the beginning of the sixteenth century, when the catastrophe known as the "Antoni-Flut" took place (1511), can be determined with some certainty by the help both of historical documents and geological research, and Dr. Schucht is able to lay them down clearly in a map which accompanies his paper. Much help towards a reconstruction of the former hydrography is afforded by the fact that the depth to which the carbonate of lime has been washed out of the silt and mud is, to a certain extent, a criterion of the date of their deposition. In the oldest deposits the process has been carried on to a depth of over 6 feet, while in the case of those which date only from 1511 its effect is not noticeable below 10 to 20 inches. A second criterion of age is the occurrence or otherwise of the "Warfen" (embankments or platforms of made ground), on which the early inhabitants formed their settlements, but which, with the increasing encroachments of the sea, have within the last few centuries been replaced by sea-walls or dykes. Almost all of the latter are of more recent date than 1511. Dr. Schucht's studies have led to results in close agreement with those lately obtained by G. Sello, and they show that current statements with regard to former channels of the Weser are in many cases incorrect. Thus the idea of a western branch, running into the Jade by way of the Line is unfounded, though it is the case that, down to the time of the "Antoni-Flut," an arm passed into the Jade a little further north, by way of the Lockfleth, while smaller connecting channels existed along the courses of the Ahne and Heete. West of the Jadebucht a channel existed along the line of the Made, the site of Wilhelmshaven being then part of an island. Dr. Schucht's map also attempts the representation of the coast-line at a still earlier date, before the Marcellus-Flut of 1219, the invasion of the sea having then reached a still less advanced stage.

Surface Forms of the Scandinavian Mountain Chain.—At the Vienna geographical gathering of May 8, 1904, Dr. Fritz Machaček delivered a lecture on this subject, giving the results of his own observations. Speaking of the problems presented by the structure of the fjeld, he drew special attention to the prevailing plateau character of the chain, a character altogether independent of the altitudinal relations, and effected by levelling of the Palæozoic chain. E. Richter, who brought the formation of this peneplain into connection with the cirque problem, assumed that the cirques were bound up with a definite fall of level towards the north, and were found only on isolated elevations rising above the fjeld-level. This assumption was at variance with the observations of the speaker, who found cirques at various heights, as also on the slopes of the trough-valleys. Seeing that the cirque-walls were in no case polished, the formation of the cirques must in the main be assigned to post-glacial time, and it might, perhaps, be possible to ascertain the relations between the varying configuration of the cirques, the height of the cirque floors, and the particular stages of retrogression of the glacial snow-line. Richter was of opinion that, as the backward cutting of the cirques progressed, and after removal of the dividing ridges, the undulating fjeld surface at last resulted. The circumstance, however, that along with this forms of Alpine type also appeared, was to be accounted for neither by mineralogical differences nor by recent crust-movements. The lecturer further deemed it impossible for extensive peneplains to have been formed by any amount of cirque-cutting. In his view, therefore, it was under the firn-covering that the fjeld preserved its pre-glacial surface, and the later demolition gave rise to rugged Alpine forms. This happened more particularly where the partition into valleys was most active and the snow-line lay deepest. The speaker pointed, moreover, to the circumstance that above the peneplain a higher summit level was likewise of constant occurrence, so that, in keeping with the investigations of Hans Reusch, two levels were to be distinguished, the formation of which, especially of the deeper and more recent, was, in all likelihood, assignable to the production of a peneplain, as understood by W. M. Davis, in the Tertiary age. The speaker next dealt with the trough-valleys, their sharp edge, the "shoulder" (the origin of which was not yet, he said, sufficiently elucidated), the "over-deepening," and the doubtful traces of valley-ledges, the step-structure of the fiords and fiord-valleys, the coast plain and its relation to the coast-lines, on which Richter and Vogt were of different opinions. In the discussion, Hofrath Penck, who in general concurred with the lecturer's views in opposition to those of Richter, traced the course of development of the inquiry. Whereas two to three decades ago the fiord problem was in the forefront of the discussion, it was now to be accounted as solved, and the forms of the fjeld had become the main problem, a change of situation due in large measure to the contributions of Eduard Richter.

ASIA.

Standard Time for India.—We are informed by the India Office that the Government of India has decided, with the general concurrence of the local authorities concerned, to adopt for their railways and telegraph offices a standard time, which in India will be five and a half hours, and in Burma six and a half hours, in advance of Greenwich time. The application of the new system to other departments, *e.g.* to meteorological observations, has not yet been decided on, but will be separately considered.

The Russian Expedition to the Khatanga, Northern Siberia.—According to a note in *Petermanns Mitteilungen* (1904, No. 4), this expedition, to which we alluded briefly in the May number (vol. 25, p. 564), safely reached Turukhansk, on the way to Lake Yessei, early in the present year, having traversed the distance from Yeneseisk in two sections.

AFRICA.

M. Gautier's Researches in the Algerian Sahara.—Valuable additions continue to be made by the French to our knowledge of the southern borderlands of Algeria, and by no one has more important work been done than by M. E. F. Gautier, whose qualifications as a geologist have enabled him to do more than the majority of African travellers to unravel the problems of the physical geography of the continent. M. Gautier's latest researches, brief accounts of which appear in the June number of *La Géographie*, have been carried out in the Tuat region, where he has made various excursions towards the west of the oasis. This, he says, does not form, as has been supposed, a basin, for towards the west it has no definite border, but forms a boundless plain broken by sandhills. Another fact brought to light is that the Wed Messaud, which was vaguely shown in some former maps, but which has lately been struck out as non-existent, is distinctly to be traced as part of an old drainage system, of Quarternary times, which is comparable to that of the Igharghar. The Messaud (of which the Wed Saura is an upper branch) has no connection with the chain of Sebkha which traverses Tuat, and occupies the line of a great fault, but runs much farther west along the edge of the little-known mass of dunes known as the Erg-esh-Sheikh. The whole system, by which the plain of Tuat was formerly drained, converges to the south-west on the salt-pans of Taudenni, which recall those of southern Tunis in which the Igharghar loses itself. From the fact that each of the great series of dunes in this region is associated with an old river-system, M. Gautier throws out the suggestion, though with much caution, that such dunes have been formed only where the former action of water has prepared the way by forming alluvial deposits. This idea will hardly be accepted without much discussion, as it tends to modify profoundly our notions of the processes of erosion and deposition in deserts.

French Surveys in the Chad-Niger Region.—Captain Tilho, who was attached to the French section of the Anglo-French Boundary Commission in Nigeria, has, since the operations of that mission were concluded, continued his surveys in the same region, especially on the eastern side of Lake Chad. Some account of his work was given in *La Géographie* for March, 1905 (vol. 11, pp. 226–230). For the survey of the labyrinth of channels on the eastern side of the lake he joined Naval-Lieutenant Audoin in the *Benoît-Garnier*, and though a severe attack of fever compelled him temporarily to make his way to the drier districts of Kanem away from the lake, he was able to do a considerable amount of mapping of the complicated features of the lake's hydrography, besides fixing the position of Mao, the capital of Kanem, and other localities. Lieut. Audoin, who is said to know the lake better than any other European, vainly endeavoured to find a navigable channel between the north-eastern and southern archipelagoes, being compelled to adopt a course which took him close to the British shore. Captain Tilho describes the winding channels which cut up the country on the east of the lake as forming a chaotic maze, from which the traveller finds it difficult to extricate himself, while without caution he may easily lose his life in the deep sloughs which encompass him. Seen from the north, *en route* for Zinder, the lake was one melancholy expanse of dry reeds. In this direction some positions were fixed along the frontier constituted by the Anglo-French arrangement of 1904, the homeward route then leading to the Niger and up the course of the river to Senegal. Numerous astronomical observations, taken along the upper Niger seem to show that its course is placed on our maps some 12 miles too far east, between Timbuktu and Gaya.

Exploration in the Ogowe Basin.—The same number of *La Géographie* records an exploration of the Ivindo, the northern tributary of the Ogowe, by M. Vaille, who, starting up the river in canoes, made the ascent amid great difficulties, caused by the furious rapids which obstruct its course, principally in its lower part. Some of the falls have a height of 110 to 150 feet and over

Higher up the river flows on a plateau, and here its swampy banks make communication impossible in the rains.

D'Anville's Map of Africa and its Sources.—The claim of D'Anville to foremost rank among the geographers of his day is very generally acknowledged, but few, perhaps, among modern students of geography could point out off-hand the precise grounds for that pre-eminence, or the way in which it was attained. The critical study of his map of Africa, first issued in 1749, which has been undertaken by Dr. Max Vollkommer of Munich (*Münchener Geogr. Studien*, No. 16, 1904), is, therefore, both welcome and instructive. In a brief introduction the author traces the outlines of D'Anville's career, laying stress on the qualities—especially the excellent critical judgment and power of sifting the true from the false among the materials in his hands—which enabled the great French cartographer to carry forward with such distinguished success the advance in map-making methods already inaugurated by Delisle.* The bulk of the memoir consists of a detailed examination of the authorities on which D'Anville's map of Africa (perhaps his most valuable service to cartography) was based in its several parts; and this enables the reader to realize in a striking way the vast industry and care employed in the collection and sifting of the material, derived both from the ancient writers and the reports of recent travellers. That the result was largely a negative one, as shown by the wide blank which occupied the centre of the map, was not the fault of the cartographer, but was due to the exceedingly scanty knowledge of the African interior existing at the time. As regards his delineations of some of the newly explored parts of the continent, especially Abyssinia, D'Anville certainly owed much to his predecessors; but while he, in the main, followed Tellez and Ludolf, he introduced certain alterations which prove that he had himself carefully studied the whole material available. As regards the Nile, he made a step in advance of Delisle's ideas by showing the Bahr-el-Abiad as a distinct stream—the main head-stream, in fact—while Delisle had identified it with the Maleg, a tributary of the Blue Nile. D'Anville's genius is strikingly shown when we look at his delineation of the western and Central Sudan, for which he had largely to rely on the older writers—Ptolemy, Edrisi, and Leo Africanus in particular—whose accounts he interpreted with great judgment, although naturally falling into many errors of detail. His separation of the Niger from the Senegal, and assignment to the former of an easterly direction, were decided services to the geography of this region. But none the less important was his mapping of the coast regions of the continent, which, being based on a study of all the most recent material, gave for the first time a trustworthy picture of the then-known portions of the continent in their true proportions, thus supplying the needed basis from which to work when the bounds of knowledge were at last advanced towards the interior.

AMERICA.

United States' Coal Industry.—A recent consular report (No. 631, Miscel. series) discusses the coal-production of the United States in 1903. In that year the total output amounted to 319,068,228 tons, the largest yet recorded, and exceeding that of 1902 by 50 million tons. The coal output of the United Kingdom in 1903 was 230,334,469 tons, 89 millions short of that of the United States. Anthracite coal is produced mainly in the state of Pennsylvania, where

* The writer holds that the attempt to put forward the German cartographer Hase as the originator of the critical cartography of Africa is unjustifiable, as his map of 1737 was itself based in part on some of the earlier work of D'Anville.

from an area of 484 square miles, the yield in 1903 was over 66½ million tons. Outside Pennsylvania, anthracite coal is worked only in Colorado and New Mexico, from which the yield was only 65,000 tons. Of bituminous coal, found in almost every state, and extending over more than 300,000 square miles, the Triassic coal-field in Virginia and New Carolina, ranging over 1070 square miles, produced in 1903, 31,601 tons; the Appalachian coalfield, extending from New York to Alabama State, over 70,807 square miles, nearly 166 million tons, of which more than half was the contribution of Pennsylvania; the northern coalfield, in the centre of Michigan State, with an area of 11,305 square miles, gave an output of 1,221,088 tons; the central coalfield, extending through Indiana, Illinois, and West Kentucky, over an area of 58,000 square miles, 46,545,407 tons (32,997,414 tons being the contribution of Illinois State alone); the western coalfield, between the Mississippi and the Rocky mountains (94,076 square miles), 20,689,010 tons; the Rocky mountains coalfield (100,110 square miles), 15,161,661 tons; and the Pacific coast coalfield (1050 square miles), 3,026,641 tons, of which 2,851,137 tons was the production of Washington State alone. Of the states, Pennsylvania, with its 92 million tons (mostly anthracite)—49·8 per cent. of total output in 1903—and employing 129,265 workers, is the coal state *par excellence*. Next, at a long interval, stands Illinois, producing near 33 million tons, 8·6 per cent. of total output, and employing 50,596 workers; then West Virginia, with 26 million tons, or 6·8 per cent. of the total, and Ohio, with 22 million tons, or 6·3 per cent. of the total. The total exports of coal in 1903 amounted to 8,813,000 tons, of which 0·79 per cent. went to Canada, 10 per cent. to Mexico, and 8 per cent. to the West Indies. The United States' import of coal in 1903 amounted to 3,446,402 tons, of which 1,785,720 tons came from Canada; 1,511,924 tons (bituminous) and 337,291 tons (anthracite) from the United Kingdom, and 296,955 tons (bituminous) from Australasia. The imports of anthracite were equal to about 0·005 per cent. of the total production, and the imports of bituminous coal to 0·01 per cent.

Dr. T. Koch's Journey on the Upper Uaupes, Brazil.—Among the great tributaries of the Amazon the western branch of the Rio Negro, generally known by the name Uaupes, has remained till the present day one of the least visited by white men. Since the river was ascended and described by Wallace not much after the middle of the nineteenth century, almost the only scientific traveller to touch upon this region was, until quite lately, the Italian Count Stradelli. Last year a visit to the headwaters of the stream was made by Dr. Theodor Koch, a letter from whom, briefly describing the journey, has lately been printed in *Globus* (vol. 87, No. 16). The ascent of the Uaupes (more generally known by the Indians as Caiary) was begun on August 4, and after some forty rapids had been surmounted, the Cuduiary, one of the most important left-bank tributaries, was reached on September 21. Everywhere the reception of the traveller by the various Indian tribes was most friendly. Continuing the voyage on October 9, Dr. Koch passed the Yurupary cachoeira, the last cataract of the Uaupes, and met with no more Indians, it being only with great difficulty that he was able to reach his goal—a settlement of Colombian "caucheros"—on the 30th. These people had only made their way to this district about eighteen months before from the Putumayo and Caqueta or upper Japura. Dr. Koch makes some forcible remarks on the shameful way in which the natives have been treated by these and other supposed representatives of civilization, which not unfrequently, he says, quite matches the atrocities committed by the early conquerors. The return journey again involved great hardships, many of the men being down with malarial fever, which prevails on this otherwise healthy river above the falls, owing perhaps to the stagnant white water. Reaching a settlement of the

Koteuas, on the Cuduiary, he ascended this stream for five days through a thickly populated district, and climbed to a plateau which seemed undermined with vast regular cavities. Dr. Koch gives some account of the various tribes of this region, which have hitherto led a retired existence away from their fellow-men. To the south, towards the basin of the Japura, he met with many tribes speaking a true Carib dialect.

AUSTRALASIA AND PACIFIC ISLANDS.

New Zealand.—The report for 1903–4 of the New Zealand Lands and Survey Department shows satisfactory progress in the way of mapping and defining areas and of the appropriation of the land. There were, in 1903–4, 2813 new selections comprising over 1½ million acres, an increase of 35,279 on the area of land selected in 1902–3; 432 of the selections were less than 1 acre each, and 166 reached 1000 acres and upwards, the average selection measuring 577 acres. Under the Village Settlement system there were, on March 31, 1904, 2014 settlers holding 43,146 acres, an average of 21¼ acres each. In view of the great shrinkage of land inviting settlement and other drawbacks, the record of land operations must be accounted satisfactory. The gross total of milling timber on Crown lands is estimated at 21,000 million superficial feet, Nelson district heading the list with a volume of about 6000 million superficial feet of all varieties, closely followed in order by Westland and Wellington. The Crown kauri timber in Auckland is found to be below former estimates, and as there are about thirty-six kauri mills clearing 144 million superficial feet per annum, in eight years the colony's supply of kauri would be exhausted. However, the timber of the rimu, matai, and totara forests in the north is now found far in excess of previous computations. The output of all the mills in the colony is estimated at 372 million superficial feet per annum, a rate which would clear away all the colony's timber in seventy years. On the other hand, over 6¼ million trees were raised in the nurseries and plantations in 1903–4 as against 4 million in 1902–3. The total number of trees raised between 1896 and 1904, on an area now measuring 1040½ acres, was 18,293,682. The prison-labour applied to tree-planting has proved every way profitable, notably in a moral sense to the prisoners. The weight allowed to the claims of natural beauty may be gathered from the assignment of ample areas as scenic reserves. More particularly, in the highly picturesque south land it is proposed to preserve in native immunity no less than 2,772,440 acres, including the Sounds National Park of 2,500,000 acres. During 1903–4 triangulation continued more or less in abeyance owing to settlement requirements, but the surveyor-general urges the resumption of triangulation on a large scale. A full report of the magnetic work of the year is furnished by Mr. Skey. Particularly interesting is the reference to the joint work of the Hagley Park observatory and the Antarctic Expedition. Eight photographs of the most marked seismograms of the year are appended. In the northern part of the South island magnetic work has been suspended since February, 1904. A further three months' work by one officer is all that is now needed to complete the magnetic survey of the colony, the results of which would be of so great value as well to navigation as to pure science. The comprehensive report deals also with temperature, rainfall, sanctuaries for animals and birds, etc. Besides maps and plans, there are numerous illustrations of scenery, flora, fauna, etc. The report of the minister of railways shows the railway mileage of New Zealand as 2328.

POLAR REGIONS.

The Duke of Orleans' Cruise in the Arctic Seas.—The Duke of Orleans sailed from Christiania on board the *Belgica*, the ship of the late Belgian Antarctic

Expedition, on May 6 last. The *Belgica* is commanded once more by Lieut. de Gerlache, and it is hoped that some scientific work will be done during the cruise, two scientists, Dr. Recamier, and Mr. Koefoed from the Bergen biological station, having joined the ship. The researches to be carried out will be made in connection with the International Commission for the exploration of the northern seas, and the lands at which it is expected to touch are Jan Mayen, East Greenland, Spitsbergen, and Franz Josef Land. A look-out will be kept for news of the Ziegler Arctic Expedition.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Origin and Growth of Ripple-mark.—The *Proceedings of the Royal Society* for April 10, 1905 (vol. 74, No. 506), contain the abstract of a communication by Mrs. Ayrton, describing experiments in regard to the origin and growth of ripple-mark, which were alluded to by Prof. Darwin in his lecture at the Cambridge Meeting of the British Association last year. The result of the experiments is to confirm the truth of the principle already recognized by other observers, that the prime cause in the formation of ripple-marks in a previously smooth surface is the variation in the rate of the current flowing over it; but they have added somewhat to our knowledge of the precise mechanism by which the given result is attained. Mrs. Ayrton found that a single ridge forms wherever the water happens to have the same place of maximum longitudinal velocity during several oscillations. That as soon as this ridge is high enough (less than a millimetre being sufficient) the water in flowing over it forms a spiral vortex with horizontal axis, which starts a new furrow and ridge in the lee of the first, the process being continued until the whole sand is ripple-marked. It was also found that "ripple vortices" came into existence only during the time when the water was rising above the mean level. In cases where the maximum horizontal velocity remained in the same place for a considerable time, as at the loop of a stationary wave, the ridge was found to grow into a ripple-marked heap, which was highest at the loop and lowest at the nodes. While not bringing to light any new principle, these experiments are useful for the support they give to conclusions reached otherwise on theoretic grounds.

The Origin of "Nieves Penitentes."—In spite of the many attempts, some of them more or less satisfactory, which have been made to explain the mode of origin of the well-known *nieves penitentes* of South America, the phenomenon continues to exercise the minds of physical geographers, and several new discussions of the question have lately appeared. Some of these contain suggestions which may help towards a fuller elucidation of the details of the problem, though the general principle—put forward independently, a few years back, both by Prof. Hauthal and Sir Martin Conway—that the primary cause is the differential action of the solar radiation, does not seem to be invalidated. In the *Sitzunsberichte* of the Munich Academy of Sciences (*Math. Phys. Klasse*, 1904, Heft III.), Prof. S. Günther calls attention to the close similarity between the *penitentes* and earth-pyramids, and argues that this must be due to a similarity of origin. He enters somewhat fully into the causes to which earth-pyramids are due, holding that the capping by a stone or rock, though no doubt exercising a protective influence, is by no means of fundamental importance, but that the true cause is the dissection of a deposit of loose material by running water, first into continuous ridges, and afterwards (by an extension of the process) into single pyramids. This, too, he supposes to have been the mode of formation of the *penitentes*, their arrangement in regular rows being thus accounted for. To explain this regularity of arrangement, Prof. Deecke (*Globus*, vol. 87, 1905, No. 15) has recourse to a supposed wave-formation induced on the surface of the snow by wind, giving an instance of a somewhat similar phenomenon observed by him in Europe in the case of snowdrifts thrown into wave-like forms and subsequently compacted by freezing. But against this is to be set the statement that the *penitentes* are usually found in spots sheltered from the wind. Perhaps the most ingenious explanation of the whole phenomenon is that suggested by Curt Facilides, in the *Mitteilungen des Deutschen und Oesterreichischen Alpenvereins* (1904, No. 21). This writer considers especially (1) The regular arrangement in parallel rows, directed in the Andes from north-west to south-east; (2) the limited zone of latitude within which the phenomenon has been observed. As regards the first point, he holds that the true cause is the shadow cast by the irregularities in the surface of the ice during the limited space of time (12 to 3 o'clock) in which the solar radiation is powerful enough to exercise much influence. The larger irregularities will, by their shadow, protect those lying behind them in the direction opposed to the sun, while the smaller will melt the sooner, thus exposing to the effects of radiation those lying behind in a similar direction. (It may be remarked that in any haphazard arrangement of such irregularities, there will always be certain systems running in a given direction, and in the case of these the protective influence of the shadows would, no doubt, be especially operative.) If this explanation is correct, it supplies a reason also for the limitation of the phenomenon to a definite zone of latitude, for not only must the elevation of the sun at noon reach a certain minimum, but there will be also a maximum beyond which the shadows thrown will be too small to have the supposed effect. It is, however, to be remarked that a formation closely resembling the *penitentes* has lately been observed by Prof. Uhlig on Kilimanjaro (*Zeits. Ges. Erdk. Berlin*, 1904, p. 632), so that the phenomenon would not seem excluded from the equatorial zone. This observer seems inclined, like Prof. Günther, to attribute the linear arrangement to the action of the water-runnels, which would follow a direction parallel to the slope. These two writers likewise agree in distinguishing the *penitentes* from the *Karren* formed on the surface of glaciers, though while Prof. Günther says that the former are really formed in ice, not snow, the latter, like Sir Martin Conway, speaks of the substance in question merely as hardened snow.

Bird Migration: Dates of Arrival.—During the preparation of a work on bird migration, Dr. Koepert, of Dresden, has bestowed much attention on the dates of arrival of summer visitors at their nesting-places in Germany, and the special causes which determine them. He gives the results of his study in a recent number (1905, No. 8) of the *Naturwissenschaftliche Wochenschrift*, published at Jena. After pointing out that the date of arrival is progressively later as the latitude and altitude increase, he says that this is not due, as might at first sight be thought, solely to differences of temperature, as evidence exists for the power of birds of warm climates, owing to their feathery covering, to stand a considerable degree of cold, provided their food-supply is maintained. In tracing the relation of the date of arrival to the temperature of different places in Germany, he finds that the available direct observations of temperature do not suffice for the purpose, and therefore has recourse to the phenological observations made of late years in regard to vegetation, which is, of course, closely dependent on temperature. Taking first the case of the nightingale, he finds an almost entire agreement between the date of arrival and the advance of vegetation in various localities, and while allowing that this may in part be due to the need of a screen of vegetation for nesting purposes, he considers that the determining factor is the appearance of the lower organisms of the animal kingdom, which form the food of the birds, such appearance itself depending on the awakening to life of the vegetation. These conclusions are only what might have been arrived at by *a priori* reasoning, but it is useful, no doubt, that they should be fortified, as is done by Dr. Koepert, by exact data. It may, perhaps, be asked whether enough weight is given to the simple factor of the distance to be traversed between the winter and summer home, which must, of course, exercise some influence, though it does not account for the retardation due to elevation. Also it must be allowed that temperature exercises a direct influence, in so far as the growing warmth of the winter habitat must, in part at least, supply the impetus for the migration, though this will be also due to the instinct to seek the original home for breeding purposes.

GENERAL.

Captain Scott and Sir F. Younghusband at Cambridge.—Among the degrees conferred at Cambridge last month *honoris causa*, were those given to Captain Scott and Sir Francis Younghusband, who both received the degree of Sc.D., their services to the cause of knowledge being described in suitable terms by the public orator.

The Oxford Geographical Scholarship, 1905.—An examination for one scholarship of the value of £60 will be held on October 12 next. Candidates, who must have taken honours in one of the final schools of the University, should send in their names to the Reader in Geography, Old Ashmolean Museum, not later than October 2.

Award to Dr. Vaughan Cornish.—The International Jury of the St. Louis Exposition have awarded a silver medal to Dr. Vaughan Cornish, F.R.G.S., for his photographs of waves in water, sand, and snow.

The Earliest Cartographer of the North.—In May, 1904, Dr. Axel A. Björnbo delivered a lecture before the Norwegian Geographical Society on Claudius Claussön Swart, or, as he is more frequently called, Claudius Clavus Niger. He was born in Denmark in the year that war broke out between Queen Margrethe and King Albrecht (1388), and was educated in a monastery school, probably in Sorö. About 1412 he left his native country, and the winter of 1423–4 he spent in Rome, where he made the acquaintance of the papal secretary, Poggio. An early map of Clavus was discovered in 1835 at Nancy, which showed a great improvement over earlier maps, and contained Greenland and Iceland. It was accompanied by a description in manuscript. Subsequently it was discovered that two German geographers of the beginning of the sixteenth century had quoted Clavus, but their citations, though agreeing together, were not in accordance with the Nancy manuscript. In 1888 several hand-drawn maps were found in Warsaw and Florence which showed a resemblance to the Zeno map of 1558, which Zeno the younger declared to have been drawn after a map of about 1380. Dr. Björnbo relates the discussions that ensued, and how he himself proved, by the discovery of a manuscript at Vienna, that Clavus was the author of the map, having acquired better information after the compilation of the Nancy map, and having travelled up the coast of Norway. This was the best map of the northern countries until the appearance of those of Ziegler and Olaus Magnus in 1532 and 1539, and as regards Greenland its influence may be traced far into the seventeenth century.—*Det Norske Geogr. Selskabs Aarbog*, 1903–4.

OBITUARY.

Obituary of the Year.

The following is a list of the Fellows who have died during the year 1904-1905 (April 30):—

W. M. ALLPORT; J. N. ARTHUR; J. W. ANDERSON; CHAS. H. ALLEN; WM. ALLEN; Captain C. ALEXANDER; Sir E. F. ALFORD; H. P. BRANDRETH; Rev. G. J. BRIDGES; W. A. BROWNE; Sir MICHAEL BIDDULPH; Major G. H. BRETHERTON; Mrs. BISHOP; Major-General R. C. BROOKE; Captain E. P. W. BROWNE; GEO. J. BRIDGES; E. L. BOYD; Sir W. L. BOOKER; Lieut. BACON HABEL; General J. BAYLY; Hon. O. BORTHWICK; The Earl of BECTIVE; Dr. A. BASTIAN; H. E. CHARLESWORTH; G. M. COURAGE; W. CHAPMAN; JOHN COHEN; WM. COTESWORTH; JAMES CAMPBELL; General A. C. COOKE; Sir JOHN DORAN; JOHN DALE; Hon. JOHN DOUGLAS; E. M. DENNY; Colonel C. A. W. FINCH; FREDERICK GAHAN; ROBERT GORDON; Rev. M. GALBRAITH; H. R. GRELLET; W. P. GOULDING; Major E. GUINNESS; Captain H. E. HAYNES; Count HOYOS; Captain HENDERSON SMITH; HENRY HANSARD; J. A. JONES; W. J. JOHNSTON; Captain E. T. JAMES; Sir FRANCIS JEUNE; Colonel W. W. KNOLLYS; N. W. LEVIN; Lieut. F. G. I. LILLINGSTON; R. LLOYD JONES; WM. MAY LINDSAY; Sir JOHN McNEILL; JAMES MACBRAIRE; W. G. MACGREGOR; Sir D. H. MACFARLANE; Canon A. P. MOOR; DATO JAMES MELDRUM; R. B. MOORHEAD; F. D. MOCATTA; G. J. MORRISON; FRANK McCLEAN; J. G. MEGGS; Field-Marshal Sir H. W. NORMAN; Lord NORTHBROOK; T. W. H. OAKLEY; Admiral Sir ERASMUS OMMANNEY; T. F. PERROTT; CAMPBELL PRAED; WM. HY. POTTER; Captain H. A. F. PLATER; Dr. R. A. PHILIPPI; Admiral J. C. PURVIS; E. J. PAYNE; FRANK RUSSELL; FREDERICK RATZEL; C. BOYD ROBERTSON; ELI SOWERBUTTS; Sir H. M. STANLEY; WM. JOHN SHARPE; HUGH STOWELL SCOTT; Colonel C. E. STEWART; C. P. SEROCOLD; The Earl of SOUTHESK; STEPHEN WM. SILVER; J. HENWOOD THOMAS; General Sir RICHARD TAYLOR; JOSEPH TUCKER; JAMES LEWIS THOMAS; Baron TOLL; THEODORE UZIELLI; CHARLES WINNECKE; DUDLEY ALEX. WEST; R. WILLIS; Dr. A. BLAIR WATSON; STEPHEN WAND; Captain W. G. WHITE; LEEDHAM WHITE; JOHN A. WOODALL.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1904-1905.

Anniversary Meeting, May 22, 1905.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair

The Secretary read the minutes of the last Anniversary Meeting, which were confirmed and signed by the Chairman.

The Secretary read a list of the newly elected Fellows of the Society.

ELECTIONS:—*Sir Robert Edward Bredon, K.C.M.G.; Cecil Clementi, M.A; Leonard Victor Dalton; Frederick Wm. Grantham; John Frederick Oiesen; Captain Hugh D. E. O'Sullivan, R.M.*

The presentation of awards then took place.

The PRESIDENT: Sir Martin Conway, the Council have felt that your numerous services to geography fully deserve one of the Gold Medals of the Society, and His

Majesty the King has approved of the selection. The Council are fully alive to all your valuable Alpine work and your exploration of the Mustag Himálaya. Your examination of lofty passes and glaciers shows how much can be done by the courage and ability of a private explorer under the most difficult circumstances. You returned with a large-scale map as a result of a most interesting journey. You then turned your attention to Spitsbergen, and you were not content with going in the old tracks and following the coast-line, but you determined to explore the interior and to give us a knowledge of it, and you did that successfully. But what is to be admired most, I think, is that you combined research with your explorations, the evidence of which is the volume which you edited for the Hakluyt Society, and your bibliography, and a most interesting and valuable geographical work on early whaling, Dutch and English, and on the Russian fishermen in Spitsbergen, which we all hope will be soon issued through the Cambridge Press. Next you turned your attention to South America, to the Bolivian Andes, and attacked the great peaks of Illimani and Illampu, making a careful survey, which added very largely to our knowledge of that part of the Andean region. Nor did we forget your ascent of Aconcagua and your attempt on Mount Sarmiento in Magellan straits, so that your services to geography have been cumulative and have been performed in many regions. It gives me very great pleasure to place in your hands the Founder's Medal.

Sir Martin Conway: It would be false modesty on my part if I were to profess indifference, or anything short of exceeding pleasure and gratitude, at the receipt of this medal which has been given to me to-day. It adds enormously, I think I may be believed when I say, to the pleasure of receiving it, that I do so at the hands of Sir Clements Markham, as one of the last actions of his distinguished presidency. I must add that in receiving it I feel how large a share of such merit as has been earned belongs not by any means to me, but to the loyal helpers and companions I had in my various journeys. Certainly no traveller more than I, I think, has been so dependent upon the assistance that he has received from his companions, and I would not like to sit down without especially mentioning the name of my excellent and valued friend and colleague in my Himalayan journey, Major Bruce, of the 5th Ghourkas; certainly without him that journey would never have accomplished such success as it attained, and in receiving from the hands of your President this testimony, I accept it fully as much as a testimony to him, in so far as it applies to the Himalayan journey, as to myself.

The President: Major Ryder, when we heard of the work you were doing in Tibet we felt that the other Gold Medal of the Society was due to you, and His Majesty the King has approved of our choice. I think it is more than ten years since you began your geographical surveys, when you were with our lamented friend Colonel Woodthorpe on the Mekong Boundary Commission. You then served in Yunnan with Major Davis, and did an enormous amount of valuable survey work, and afterwards with the expeditionary force in Northern China, when you were present at the relief of Peking, and again did valuable survey work. But of course the great interest of your services is in Tibet, when you were under the orders of Sir Frank Younghusband and General Sir Ronald Macdonald, and you have, by an excellent survey, connected British India with the famous city of Lhasa. You have made large-scale plans of Lhasa and Gyantse, and after parting company, when you went on with Captain Rawling, you did most valuable and interesting survey work along the whole of the course of the Sanpu to its source, where no Englishmen have ever been before, and you finished with exceedingly interesting and valuable work on the Gartok branch of the Indus and the source of the Sutlej. We all think that in giving you this medal at your age you will be sure to wish to do more, and it will be a certain incitement to you to undertake further work on behalf of geographical science. I have much pleasure in placing the Patron's Medal in your hands.

Major C. H. RYDER: I thank you most warmly for this medal, which I, in common with all explorers, look on as the blue ribbon of an explorer's life. In all the journeys that I have had the good fortune to make, I have been, first of all, extremely fortunate in the officers under whom I have had the honour to serve. In Yunnan, in the two years' exploration that I undertook there, I was under Major Davis, who is an expert in Western China, and during the time I was in Tibet I was under Sir Frank Younghusband and Sir Ronald Macdonald, both of whom have always taken the warmest interest in geographical work. Also I have been most ably assisted throughout my work by many officers and surveyors, particularly Captain Wood and Captain Cowie and many native surveyors who have always assisted me in the most able manner. I am particularly glad to have been able to do this work in Tibet during the time that you have been President, sir, as we all know the very great interest that you have taken in Tibetan work. At the same time, I hope I may have the good fortune at some future period to wander about the world somewhere else.

The PRESIDENT: Mr. Bartholomew, it has been, since I have known it, the desire of this Society to recognize the valuable work of geographers at home as well as the important work of geographers abroad. My old friend and revered predecessor, Sir Roderick Murchison, felt this very strongly. He presented one gold medal to Mr. John Arrowsmith, and another to Mr. Augustus Petermann, and he selected Mr. A. K. Johnston for another when he was struck down with his fatal illness. As a matter of fact, Mr. A. Keith Johnston received the medal from Sir Henry Rawlinson. Our Council has always desired to follow Sir Roderick's excellent example, and has instituted a special medal for research. When our revered sovereign Queen Victoria died, we were very loth to lose her effigy from our medals, and this medal for research was consequently instituted as the Victoria Medal. With perfect unanimity, the Council has felt that your great merits deserve recognition in the form of our Victoria Medal. By your important work, and especially by your beautiful atlas of Scotland, by your survey atlas of England, and by the first volume of your great physical atlas, you have certainly raised the standard of cartography in this country, for you have not only striven, and striven successfully, to produce very beautiful and graphic execution on your maps, but you have also during many years occupied yourself in geographical and statistical research, so that we feel that you are not only a very eminent cartographer, but also a scientific geographer. In both these capacities, I have very great pleasure in presenting to you the Victoria Medal in the name and on behalf of the Council of this Society.

Mr. BARTHOLOMEW: So far as honours go, I have always regarded the Victoria Medal of the Royal Geographical Society as the summit of a cartographer's ambition. I can certainly assure you, sir, that no honour could be more appreciated by me than this most gratifying recognition of my work, and to receive this recognition whilst still in the enjoyment of one's full working powers is a very great encouragement to further effort, although in cartography, as in everything else, one's highest effort must always be inspired by ideals. Whatever the progress of cartography may have been in the past, there is undoubtedly great scope for its development and improvement in the future, and it is certain that our efforts towards the promotion of geographical education in the universities and schools of this country must soon lead to the appreciation of a much higher standard of work. When I think of the famous geographers who have received this same medal in the past, from Carl Ritter down to Arrowsmith, Keith Johnston, Reclus and Ravenstein, it would almost seem to reflect upon us at the present day that we have not achieved more in mapping the varied phenomena of our globe. But progress cannot be rushed; we must necessarily take public education with us. On this occasion, however, I feel I should be a most unworthy son of my patronymic ancestor, Ptolemy, the first map-maker, if I did not claim for cartography its fullest measure of importance—I would certainly go the length of saying that it would be greatly to the advantage of this country if we had a wider application of cartographic methods to the demonstration of all its problems —to its vital and economic statistics, its trade, agriculture, public health, and all questions affected by geographical environment. I would even venture to say that if most of our ponderous Blue Books were reduced to cartographic summaries, they would be much better understood and appreciated. Further, if this work is worth doing for any one country, it is doubly worth doing on an international basis. We must realize that true geography is nothing if not cosmopolitan, and I earnestly trust that the International Committee of Cartography appointed last year at St. Louis may be fruitful of suggestions in this direction, especially as regards the unification of international cartographic methods. In tendering my very cordial thanks to your Council for this medal, I would like to add, sir, that to me its value is greatly enhanced by receiving it from your hands at the close of your long and distinguished Presidentship of this Society.

The PRESIDENT: The Murchison Grant has been awarded to Mr. William Wallace, who has done such important geographical work in Nigeria, and read us a very interesting paper on the subject. The Back Grant has been awarded to Captain C. Maud, for his valuable work connected with the examination of the southern borders of Abyssinia. The Cuthbert Peek Grant has been awarded to Mr. Francis J. Lewis, for his valuable contribution to our knowledge of botanical distribution in the north of England. He has chosen to take it in the form of a field-glass. The Gill Memorial has been awarded to Colonel Maunsell, for his explorations during many years in Asia Minor, and for the valuable map he has presented to us. It will take the form of a silver cup.

The President then delivered his anniversary address (see p. 1).

The Report of the Council was then read; it will be published in the next Year-book. The President announced that, as a result of the ballot, the Council as proposed had been duly elected. The list is as follows, the names of new members, or of those changing office, being printed in *italics* :—

President: Right Hon. Sir George D. Taubman Goldie, K.C.M.G., F.R.S., D.C.L., LL.D. *Vice-Presidents :* Sir H. E. G. Bulwer, G.C.M.G.; Colonel G. Earl Church; Colonel Sir Thomas Hungerford Holdich, K.C.M.G., K.C.I.E., C.B., R.E.; *Colonel D. A. Johnston*, C.B., R.E.; *Sir Clements R. Markham*, K.C.B., F.R.S., F.F.A.; Sir George S. Mackenzie, K.C.M.G., C.B. *Treasurer :* Edward L. Somers Cocks. *Trustees :* Right Hon. Lord Avebury, D.C.L., F.R.S.; Lord Belhaven and Stenton. *Hon. Secretaries :* Major Leonard Darwin, R.E.; James F. Hughes. *Foreign Secretary :* Sir John Kirk, K.C.B., G.C.M.G., F.R.S. *Councillors : Admiral Sir Nathaniel Bowden-Smith*, K.C.B.; Admiral Sir James Bruce, K.C.M.G.; J. Annan Bryce; Major Chas. F. Close, C.M.G., R.E.; Prof. J. Norman Collie, F.R.S.; Captain Ettrick W. Creak, C.B., F.R.S., R.N.; *Douglas W. Freshfield ;* Prof. E. J. Garwood, F.G.S.; F. H. H. Guillemard, M.A., M.D.; *Sir Clement L. Hill*, K.C.M.G., C.B.; D. G. Hogarth, M.A.; Sir Harry H. Johnston, G.C.M.G., K.C.B.; Admiral Sir Albert Hastings Markham, K.C.B.; *Right Hon. Sir Joseph West Ridgeway*, K.C.B., G.C.M.G., K.C.S.I.; *Major C. H. D. Ryder*, R.E.; *Captain R. F. Scott*, C.V.O., R.N.; Colonel Sir Colin C. Scott-Moncrieff, K.C.M.G., C.S.I., R.E.; General J. H. M. Shaw Stewart, F.R.S.E., R.E.; *Colonel Hon. M. G. Talbot*, R.E.;

Colonel Sir Henry R. Thuillier, K.C.I.E., R.E.; Commander David Wilson-Barker, R.N.R., F.R.S.E.

After the announcement, the PRESIDENT said: I now have the pleasing duty of announcing that the Council's list has been unanimously adopted, including Sir George Goldie as your President. Sir George Goldie is well known to us all as the able administrator, the great promoter of geographical exploration, and the founder of Nigeria. He has been a Fellow of this Society for twenty-eight years, a member of our Council for fourteen years, and Vice-President for nine years. He is, therefore, well acquainted with your business. He has qualifications, as a councillor, which I do not possess. I am indebted to him for advice and help of such value and importance that I am quite unable sufficiently to express my gratitude to him. I congratulate the Society on the acquisition of so very able a President, who will be devoted to its interests.

Sir THOMAS HOLDICH: I wish to say a very few words with reference to what Sir Clements Markham has told us about the necessity that he feels for resigning the high position of President and being succeeded by Sir George Goldie. They will be very few words, for this is not the place to enter into a history of Sir Clements Markham's long connection with this Society; besides, I think the record of the work that he has done in that connection is to be found pretty amply in the chronicles of the Society itself: I believe that there are, at least, twenty-four volumes of the *Journal* of the Society which are full of them. But what I wish to say specially from the members of the Council, and I think for all those who are here, is this—that when Sir Clements leaves that chair we shall miss him—we shall miss him sorely from the accustomed place. Other men may come, and will come, and they will give us some of their time, no doubt, and the best of their ability towards solving the complicated problems which continually come before the Society; but it will not be quite the same thing, for Sir Clements' connection with the Society has been something more than heart-whole—it has been almost life-whole. With him it has been the Society, the whole Society, and nothing but the Society; and in these busy days we can hardly expect that from anybody else in future. But I think that if Sir Clements looks back over the twelve years during which he has been President, he can see for himself what has been done during that time; indeed, he has recounted some of it to us just now—he will *see* that the Society is now placed quite first amongst all Geographical Societies of the world; high in the estimation of all scientific people as an educational factor in England; and he will certainly be proud of his work; whilst we, looking back over the same time, may fairly say that we are proud of our President. Taking it for all in all, we are not likely to see another quite his equal. His name will ever be connected with the best and the brightest annals of the Geographical Society; and I will only add that whilst we all seriously deplore that there should be reasons which lead him to resign his position as President, and although we shall miss his steady hand at the helm and his constant watchfulness over the course which our ship is steering, yet still we hope to have the benefit of his advice, that advice which is always so freely and so frankly given to anybody who asks it, and his counsel, which is a counsel matured by a long experience and probably an unequalled acquaintance with all the varied interests of this great Society.

Colonel FEILDEN: I am sure all present, both Fellows and visitors, will agree with the tribute of Sir Thomas Holdich to our President. I was told that I was only to speak for one minute, and that is a very short time in which to say what I should like to, for if I had my own way I should speak far longer in regard to Sir Clements Markham. I shall not venture to say anything of his incomparable services to geography; but there is one phase of his many-sided character which I should like to refer to, and that is not only in the Council room and in the whole working of the Geographical Society, but in his more private life. When any young traveller, or any one willing or desirous of obtaining information, applied to Sir Clements Markham, there was no one in the world so willing to give it as our President, and no labour seemed to prevent him doing so. I have had the honour of Sir Clements Markham's acquaintance for over thirty years, and during that time, whenever I was at a loss and could not find what was wanted in the Encyclopædia Britannica or the Century Dictionary, whatever the point might be, geography, genealogy, historical records, or almost any subject, I applied to Sir Clements Markham, and I invariably, by return of post, received a reply, and a satisfactory one. I beg to offer our sincere feelings of respect and regard to our President.

Sir CLEMENTS MARKHAM: I have been deeply touched by the way you have received the two speeches from such very old friends, both of whom I have known for very many years, one from the Arctic Regions and one from the Tropics. They, of course, have drawn a picture without any shadow in it, which is not very artistic. Still, it is extremely kind of them to say all they have, and I feel it very deeply. I also feel the kindness with which you have received their speeches.

BANQUET TO SIR CLEMENTS MARKHAM.

On the evening of the anniversary, May 22, a banquet was given by the Fellows of the Society in honour of the retiring President, Sir Clements R. Markham, K.C.B., F.R.S. The new President, the Right Hon. Sir George Taubman Goldie, K.C.M.G., and about three hundred were present. Among those present were the following: The Earl of Camperdown; Lord Eustace Cecil; Lord Belhaven and Stenton; General Lord William Seymour; Lord Colchester; Admiral of the Fleet, Sir F. A. Richards; Admiral Sir Walter Hunt Grubbe; Admiral Sir Vesey Hamilton; Prof. Henri Cordier, representing the Paris Geographical Society; Colonel Sir Thomas H. Holdich; Admiral Hon. Sir E. R. Freemantle; General Sir Richard Harrison; Admiral the Hon. Sir A. Cochrane; Admiral Sir Albert Markham; Sir Frank Younghusband; Sir Montagu Ommanney; Sir George S. Mackenzie; Sir W. R. Anson; Sir Henry Bulwer; Agent-General for New South Wales (Hon. T. H. Coghlan); Agent-General for New Zealand (Hon. W. P. Reeves); Agent-General for Queensland (Sir Horace Tozer); Agent-General for Victoria (Hon. J. W. Taverner); Admiral C. R. Arbuthnot; Sir W. T. Thiselton Dyer; Sir Colin Scott-Moncrieff; Mr. G. E. Buckle; Major C. H. D. Ryder; Sir Martin Conway; Mr. A. B. Kempe, Treasurer for the Royal Society; Colonel H. W. Feilden; Rt. Hon. W. Ellison Macartney; General Sir Ronald Lane; Captain R. F. Scott; Archdeacon of London; Colonel Sir George Leach; Sir J. G. Scott; Prof. James Geikie, President of the Scottish Geographical Society; Sir A. Moloney; Mr. Anthony Hope Hawkins; Sir Harry Johnston; Dr. Gow; Dr. Blyden; Colonel G. Earl Church; General Shaw Stewart; Mr. Maw, President of the Royal Astronomical Society; Mr. Yates Thompson; Mr. J. Annan Bryce; Mr. Fabian Ware; Dr. W. T. Blanford; Colonel E. S. Milman; Mr. Hugh Chisholm; Mr. Douglas W. Freshfield; Colonel C. E. Yate; Captain C. G. Rawling; Major Leonard Darwin; Mr. J. F. Hughes; Mr. Edward L. S. Cocks; Colonel C. M. Watson; Colonel A. J. Arnold; Mr. J. G. Bartholomew; Major C. F. Close; Mr. H. J. Mackinder; Mr. Reg. J. Smith; Colonel Le Messurier; Sir Ernest Clarke; Lieut. Skelton; and the staff of the Society.

In the intervals between the toasts, a programme of music (quartettes and solos) was performed.

In proposing the toast of "The King," the PRESIDENT said: Sir Clements Markham, my lords, and gentlemen, I rise to propose the toast that always stands first at gatherings of this kind throughout the empire. But before doing so I wish to read a letter from Sir Dighton Probyn which Sir Clements Markham has handed to me. It is dated May 20, and addressed to Sir Clements Markham—

> "I am commanded by His Majesty to say it is with regret he learns that you feel you must resign the office of President of the Royal Geographical Society. The King commands me to add that he, as Patron of of the Society, cannot allow you to retire from the Presidency without thanking you for and congratulating you on the able, zealous, and very successful manner in which you have conducted the arduous and important duties connected with the Geographical Society during the twelve years you have been at its head."

I think it would be unbecoming of me to add any remark of my own beyond expressing the gratitude of the Royal Geographical Society to their Patron, His Majesty the King, for the graceful and appreciative way in which he has caused the letter to be written to our twelve-years' President, Sir Clements Markham. I therefore give you at once the Toast, "His Majesty the King."

In proposing the Toast, "Her Majesty the Queen, H.R.H. The Prince of Wales, The Princess of Wales, and other Members of the Royal Family," the PRESIDENT said: My lords and gentlemen, I now rise to give you the second loyal toast, and it is, "Her Majesty the Queen, H.R.H. The Prince of Wales, The Princess of Wales, and other Members of the Royal Family." But here again I have a letter to read, also handed to me by Sir Clements Markham. This is written by Sir Arthur Bigge, who says—

> "DEAR SIR CLEMENTS MARKHAM,
>
> "The Prince of Wales desires me to tell you how much he regrets to learn from the newspapers that you are about to resign the office of President of the Royal Geographical Society, which position you have held with so great distinction for many years."

I think I need not add any remark excepting that we receive the expressions of our Vice-Patron with the same gratitude as we received those of his illustrious father. I beg to give you the toast.

The PRESIDENT next proposed the toast, "The Guest of the Evening, Sir Clements R. Markham, K.C.B., F.R.S.," and said: My lords and gentlemen, it has been the unbroken custom of the Royal Geographical Society for more years than I can remember, and I believe, on good authority, from time immemorial, to commemorate its foundation by an Anniversary Dinner held on the day, which is to-day, of the Anniversary Meeting. For once that commemoration is in abeyance. We have met here to-night to do honour, not to an institution, but to a man—our guest of the evening, Sir Clements Markham. And as it is my privilege, my sad privilege, because I—but you will understand—have to propose his health, it also devolves upon me to place on record the reasons that have impelled us to this exceptional, this unique, departure from our time-honoured custom. I cannot do this without reviewing to some extent the long and varied career of our distinguished guest, and yet I feel that I must not overstep too far, even on this special occasion, the limits which the progress of civilization has imposed on after-dinner speeches. My only resource is to follow the methods of those who I understand are known in other halls as "lightning artists." I must also, to my great regret, but after careful consideration, exclude from any notice whatever the numerous distinguished and well-known persons—some of them are dining with us to-night—with whom Sir Clements Markham has served, or who have served under his instructions, or who have collaborated with him in any of his undertakings. My sketch, however meagre, must be a personal portrait and not a panopticon of celebrities. Every Yorkshireman in this room, and I have seen some here, knows that Sir Clements Markham comes of a good old family of that county which has given us a champion cricket team and a champion geographer. Every old Westminster here will have fresh in his mind the references to Sir Clements Markham in the Epilogue of last December; but he must be a really old Westminster if he remembers, what I discovered in a book, that so far back as 1867 Sir Clements Markham—or, as he was then, Mr. Markham—was already so famous that he received similar humorous notice in the prologue of the Westminster play of that year. And every naval officer here—there are a good many—will remember that it was as a midshipman in the Royal Navy that our guest took part in the Arctic Expedition of 1850–51. He has just told me with a genuine air of regret that, owing to his being a junior officer—I think he called himself the "Boots" of the expedition—he was only allowed to go for forty-five days' sledge travelling. I should imagine that forty-five days' sledge travelling would be enough to nip in the bud the affections of most people for Arctic travelling. But we know that his were not affected, because we find that twenty-three years later he actually applied for and obtained special leave from the Secretary of State for India in order that he might accompany as far as Greenland—they could not allow him to go further—the Arctic Expedition of 1875. For the last few days I have been taking special interest in Sir Clements Markham, and on Saturday morning I read through his contribution to the *Proceedings*, or what we now call the *Journal*, of the Royal Geographical Society some thirty years ago, describing that most interesting voyage to Greenland and back in the *Alert* and the *Valorous*. I can recommend it to your notice. It is extremely interesting, and I took the trouble to note down the reference; it is p. 55, vol. 20 of the *Proceedings*. There can be no doubt that to the very early affection acquired by Sir Clements Markham for polar exploration we are in part indebted for his having, between forty and fifty years later, initiated and carried through that National Antarctic Expedition to which I must refer presently. After some eight years' service he passed for his lieutenancy, and then left the navy. He has not told me why. I know why, by experience. He had a passion for exploration. Having left the service, he went off to South America and explored there for two or three years, chiefly in the forests east of the Andes. After that he entered the India Office, where he remained for twenty-three years; but when I say he remained there, that is only a figure of speech. His soul was not fettered to an office stool, and he appears to have entirely disregarded the advice of Sir Joseph Porter in H.M.S. *Pinafore;* for instead of sticking close to his desk and never going to sea, Sir Clements Markham seems to have been constantly going to sea and exploring distant lands in the service of his country. I cannot closely follow him in his extensive travels; but as he had, for the moment, turned his back on "Greenland's icy mountains," we are not surprised to find him on "India's coral strand," while the breadth of his survey of mankind is perhaps best expressed by the title of one of his many publications, 'From China to Peru.' But perhaps I ought to mention that this particular work of his, 'From China to Peru,' did not describe his own travels. I have been talking to him about it during dinner. It was a question of introducing Chinese coolies into Peru, so that it is quite clear that Sir Clements Markham was the forerunner of Lord Milner. As I have mentioned his publications, let me diverge for a moment, lest I should forget, and let me draw your attention to one of the leading characteristics of our guest to-night—I mean his remarkable and perennial literary activity. I take it for granted that every Fellow of the Royal Geographical Society knows about (one could not expect him to be conversant with) the stream of publications that has come from Sir Clements Markham's pen on geography and cognate subjects, during the forty-three consecutive years he has been a member of our Council, or the fifty and more years he has been a Fellow of our Society. Books, pamphlets, articles, essays, reviews; their name is legion. But the literary world knows that he has not confined himself to these geographical subjects, but that he has dealt, equally effectively although less extensively, with many other matters. I may mention history, biography, memoirs, grammars and dictionaries of little-known languages; but the bibliography of Sir Clements Markham might occupy an evening to itself. I am not sure whether I ought to remind a learned Society that he has written a romance. But I may say in extenuation that it is a quasi-historical romance, and a patriotic romance, because it deals with the supposed adventures of those slaves, *non angli, sed angeli*, whom Pope Gregory the Great saw in Rome. I may add that Sir Clements Markham was careful not to publish this novel until after he had been elected President; but in making this remark, I do not wish to discourage any distinguished novelist who may be present, and who may think that he carries in his pocket the baton of the presidency of a learned society. Well, gentlemen, I have dwelt on his literary activity, partly, of course, on account of the intrinsic excellence of Sir Clements Markham's writings, but also because it is the most tangible, the most visible outward sign that I can present to you of that inward fire, that restless energy, that untiring industry, which only those who have worked with him can fully appreciate. But all this is by way of parenthesis, and I must go back to his foreign travels. His greatest achievement at that time was the introduction from South America into India of the quinine-yielding cinchona tree. That work is so widely known that I need not dwell upon it beyond remarking that it occupied several years and a great deal of energy, and that it produced incalculable beneficial results to large sections of the Indian population. But, to my mind, his most interesting journey must have been when he went as geographer with the British army to Magdala, at the storming of which place he was present—I do not know whether he took an active part or not (I understand Sir Clements to say that he did not kill anybody) during the Abyssinian war of 1867–68. Deeply interesting from the geographical standpoint, because Abyssinia was in those days a very little-known country, but also interesting, I think, on account of the expedition itself, which to my mind has always appeared one of the best conceived, one of the best engineered, and therefore one of the least costly in blood and money, of all the British expeditions of the nineteenth century of the same magnitude and the same military success, although, unfortunately, from a political standpoint, one of the most fruitless, owing to the deplorably low ebb to which the imperial spirit had fallen during the apathetic sixties. Partly on account of the Abyssinian expedition, no doubt, but I suppose mainly for his general valuable service under the India Office, Mr. Markham received a C.B. in 1871; and this may be a convenient moment to remind you that he received his K.C.B. in 1896, that he has been the recipient of various foreign orders of distinction, and that the Congress of Peru voted him a gold medal; and, leaving these State decorations aside, that he is a Fellow of the Royal Society, that he has been the President of the Hakluyt Society for some fifteen years, and that he has received innumerable marks of approbation from many societies both at home and abroad. Yet I am confident that of all the honours that have been showered upon him, and which are not one-half of what he deserves, there is not one that he values more highly, that he cherishes more deeply, than the Founder's Medal of the Royal Geographical Society. My confidence is based on the conviction that, although circumstances have led Sir Clements Markham into various occupations, he was really born a geographer. I do not think that he will deny the soft impeachment that geography has been the ruling passion of his life. And if a man is so fortunate, so happily balanced as to be able to live and move and have his being in the realms of science, I ask you what more attractive, what more valuable province could he choose to explore than the science dealing with this outer film of our globe, this thin film of land and air and sea where not only our own race, but where every sentient organism of whose existence we have any knowledge whatever, must dree its wierd? Born a geographer, Sir Clements Markham became a Fellow of this Society at the early age of twenty-four. Eight years afterwards he was elected a member of the Council, one of the youngest who has ever sat upon it, and the following year he was elected also to the position of Honorary Secretary, and he filled that post with great distinction for no less than a quarter of a century. In 1888, for some reason, he preferred to be re-elected only as an ordinary member of the Council. That lasted until 1893, by which time he had been for over thirty years a Member of the Council in one capacity or another, and for nearly forty years a Fellow of the Society. If at the end of that period Sir Clements Markham had abandoned the Society, an almost unthinkable hypothesis, he would even then have been handed down in its annals as a shining light; but those forty years were only a prelude to his taking possession of the promised land, for in 1893 he was elected unanimously to the chair, and he has been so re-elected to it year after year, as a matter of course, until this fatal afternoon, when to our inexpressible regret he retired on the unanswerable, the irresistible plea of need of rest. I am afraid that my remarks have a tendency to fall into the minor key of an obituary notice; but it is difficult to avoid a pathetic note in lamenting the official decease of an ideal President, especially when the speaker is an ephemeral successor to the office which he has seen raised to a standard that he cannot hope even to approach. Fortunately, the decease in question is only official, as we can see to-night. Unlike Mark Antony, I come to praise Cæsar—not to bury him; and as Sir Clements Markham, with true geographical spirit, has accepted a Vice-Presidency, he will be in a position, after a period of rest, to give to his successors the benefit, the immense benefit, of his experience and his advice. I shall not attempt this evening—I have spoken at great length already—to put before you any connected account of the services of our twelve years' President during the time that he was in the chair. In the first place, all that is modern history, and I assume that most of the Fellows of the Society are conversant with it. In the second place, Sir Clements Markham himself gave a brief account of his stewardship this afternoon at the Anniversary Meeting, which I hope a good many of you attended, while those who could not attend will find a report in the *Journal* of our Society; and I would especially draw their attention to that portion referring to the progress of education in this country, to the work which our Society has done in that direction, and to the fact that the two universities of Oxford and Cambridge have established schools of geography, each of which is partly subsidized and partly controlled by the Royal Geographical Society. But I have a third and better reason for not dealing with his Presidentship, and that is that I could not possibly condense into a few sentences any intelligible idea of the value of the services that he has rendered to geography in general, and to this Society in particular. It would serve no useful purpose if I read out a list, a sort of index, of the salient acts of his administration. You know as well as I do that administrative work whether it is ruling an empire or a brigade or a battleship or a business, consists in the main, not of striking actions, but of innumerable details, and that success depends on the initiative, the knowledge, the care, and the persistence—I dwell especially on the persistence—with which those details are managed. Now, these are exactly the qualities that have so deeply impressed me in watching the work of Sir Clements Markham during his twelve years' Presidency. But there is one matter to which I must refer, because without it any sketch of Sir Clements Markham's life would really be like the play of *Hamlet* with the Prince of Denmark left out. I refer, of course, to the National Antarctic Expedition. I think that it is generally understood now throughout the country, not only that Sir Clements Markham initiated the expedition, but that he had, in the first place, to create that public opinion without which progress was impossible. From the day that he became President he took up the matter actively. For some years I used to watch, with admiration mixed with a good deal of scepticism as to the result, his efforts to procure the sinews of war. At last he got the money, thanks to one generous donor, to a large subscription of the Geographical Society, to a great number of smaller subscribers, and to a much-abused Treasury; and having got it, he threw himself heart and soul into the organization of the expedition, and neglected no detail, however minute, that could contribute to its success from the point of view of either geographical exploration or of scientific research, and no detail tending to minimize the risks to the health or lives of those concerned; and I think that his arduous work and anxiety must be almost compensated by the magnificent results achieved. But as the expedition is to form the subject of the next item on our toast list, I must not further pursue the topic beyond expressing the opinion that it has added to the laurels of the navy, to whose officers and men was entrusted the carrying out of the work; that it has been a genuine satisfaction to the nation, whose maritime primacy, whether naval or commercial, made it almost a duty, or, as Sir Clements Markham has often said, quite a duty, to establish its primacy of exploration in the Antarctic Regions; that it has been a source of legitimate pride to the Royal Geographical Society; and, finally, that it has been the crowning triumph of Sir Clements Markham's career. I think, perhaps, I have said enough to justify our setting aside an Anniversary Dinner on his behalf. There used to be a tacit convention in our Society that it would be little less than treason to suggest that any President could surpass, or even equal, Sir Roderick Murchison. I shall not attempt to weigh these two great geographers nicely in the balance. In the words of Dryden, "Let both divide the crown;" and I venture to prophesy that when the story of the first century of our Society's work comes to be written, the names of Murchison and Markham will be bracketed together as stars of the first magnitude. My lords and gentlemen, I fully decided before coming here to-night that I would speak only of Sir Clements Markham in his public capacities, because it seemed to me that in his presence and before so very large a gathering, most of whom cannot have had the advantage of working with him, and many of whom probably do not know him very intimately, it would be impossible for me to speak of him as a friend and as a colleague in the only way in which I could so speak of him. But it struck me that perhaps one short sentence might at any rate suggest the feelings in this direction of his co-workers, whether on successive councils of the Royal Geographical Society or among that admirable, that highly efficient permanent staff in Savile Row, who have so ably seconded his efforts, and that brief sentence is, that in quitting the Presidential chair he carries with him, not only our respect and admiration, but also our affection and our esteem. And I am confident that the Fellows of this Society scattered over the world will join in our fervent hope that a period of rest will speedily restore his strength, and that he may be spared for many, many years to watch the satisfactory progress of that great Society on whose behalf he has so long, so ably, so strenuously laboured. I venture, then, on behalf of the whole body of the Fellows, those absent as well as those present, to call upon you now to receive with all honours the toast of the evening, "Sir Clements Markham."

Sir CLEMENTS MARKHAM, who was received with enthusiastic cheering and the singing of "For he's a jolly good fellow," said: My lords and gentlemen, Fellows of the Royal Geographical Society, I feel so overwhelmed with all your doings this evening that no words can sufficiently convey to you my thanks. Sir George Goldie has painted a picture with no shadows in it. Now, a closer examination might have enabled some of my friends, and certainly enables me, to see that there ought to be some shadows on that picture—many shortcomings and some mistakes that I have made. Sir George Goldie has most kindly taken such trouble to hunt up all that I have done that can be considered good, that he has forgotten to look at the other side. He is such a very old friend of mine that I cannot find fault with him for this. I consider Sir George Goldie to be one of the best colleagues I ever worked with. I valued his advice more, I think, than any one else's within the last twelve years. His counsel has been most valuable to me, has prevented me from making mistakes, and has enabled me to carry through most important work. I therefore feel that in all this country at the present moment no better successor could be found than Sir George Goldie. To-day I received a letter from the Viceroy of India, our Gold Medallist, who wished to congratulate the Society, not on my retirement, but on having found so very efficient a successor. Perhaps my associates will excuse me if I refer to my beginnings as a geographer for a minute or two. I do so because I am reminded of them by the fact that my old friend and shipmate, Lord William Seymour, is sitting on my right hand. It is due to his father, Admiral Sir G. Seymour, that I first seriously turned my mind to geography. We were on a very long voyage across the Pacific, and he sent for me and told me to make abstracts for him of all the useful points in Burney's voyages and in Captain Cook's voyages. Since that time I have certainly—it is a great many years ago now—considered geography the most charming and the most useful pursuit that could be followed. Well, a few years passed on, and with great trepidation I came to read my first paper at the Geographical Society. I found an unsympathetic audience, as I thought, and an unsympathetic chairman in the person of an old admiral. Just when I was having this feeling aroused in me, who should get up, to my utter astonishment, but Sir George Seymour, and the speech he then made put such heart into me that I continued with greater zest than ever my studies and pursuits connected with geography. I will not detain you a moment longer on that subject, but will turn to the duties I considered to be mine as President. One of those duties, and I think the most serious one, was to attempt to be impartial to the equator, to the south pole and to the north pole, and to every country—not to love one better than the other. I remember there was a girl, a bad girl, in one of Dickens's novels, and she was so rude as to say, "I hate Africa." Now, the President of this Society must hate no country; he must love them all. I am afraid that I have not succeeded altogether in that, but I have endeavoured to do so. And the next duty which I considered important was that I should encourage everybody to start on geographical expeditions. I have had an enormous correspondence on this subject. The last letter I received a week ago was from a stoker in His Majesty's service. I have had numerous letters from young clerks and all sorts of people, and I have invariably written them rather long letters in reply, urging them to abandon their work and start on an expedition on the very first opportunity. Well, I have the great happiness to say that this conduct on my part has never weighed on my conscience, for it has led to no disaster. I wish to take the opportunity now offered me of thanking most warmly all the Councils of this Society who have helped me so strenuously, and with such a friendly feeling towards me, during the time I have been President. I also must remind you all that we not only have been working by ourselves in many parts of the world, but that we have had a great Society—the most ancient society in this country—joined with us to further Antarctic exploration. This is not the first time that we have had joint work with the Royal Society; we had a joint committee in 1875. It is a very difficult business, and after several experiments, we settled upon a financial joint committee of four to do the work of the Antarctic Expedition in this country. We have been so engaged now for five and a half years. I think there are at least two of my colleagues present, and I appeal to them whether we have ever had a serious misunderstanding, whether we have ever really quarrelled, whether our good fellowship and our harmony, to compare small things with great, was not like the good fellowship and the harmony which prevailed in the ward-room of the *Discovery* in winter quarters. I am quite sure, when the time comes finally to wind up our accounts, we shall part quite as good friends as we were at the first meeting we had five years ago. I can never sufficiently express my gratitude to the staff of the Society, for without a good staff and a zealous staff the President could never get his work done at all. But our staff is an exceptionally good one, and the Fellows of the Society will remember that the different heads of departments require different qualifications. They have all worked with great efficiency, have helped me in a way that I can never express sufficient thanks for, and have done credit to this Society. Finally, I wish to speak of the whole body of the Fellows; they have shown the greatest kindness to me during the whole time I have been President. I have had a very, very large correspondence with numbers of them, and I have never received an unkind word; I have never even received a complaint from any of them during the whole time. I cannot—words will not allow me—express the thanks I feel at the kindness I have received from the great body of the Fellows. I thank you all from my heart for the way this toast has been received by you.

The Right Hon. W. Ellison Macartney, in presenting a silver cup to Sir Clements Markham and a gold pen to Lady Markham on behalf of the relatives of the officers and staff of the *Discovery*, spoke as follows:—

Right Hon. W. Ellison Macartney: Sir George Goldie, my lords, M. Cordier, and gentlemen, I have to express my warmest thanks to the Council of the Royal Geographical Society for affording me an opportunity on this memorable occasion of presenting, on behalf of the immediate relatives of the officers and scientific staff who served on the Antarctic ship *Discovery*, a souvenir to Sir Clements Markham of those long and eventful months when that ship lay in Antarctic waters. We know well that from the moment the organization of this expedition began, until that ship was moored in a home port, we have great reason to be deeply grateful to the Council of this Society, to the joint committee of this Society and of the Royal Society, and to the Government, for the invaluable assistance which they rendered in safeguarding those who were engaged in Antarctic exploration. But, gentlemen, there is always one man in these affairs on whose shoulders lies the weight of supreme responsibility, to whom the relatives of those who are absent will always go for sympathy and for counsel, or for the inspiration of hope and confidence, and it was on Sir Clements Markham that this heavy burden lay in this instance. Gentlemen, I need not say that he never failed; he made us all feel confident that everything that long and accumulated experience, that prudent foresight could imagine, had been done to secure the safety of those who were engaged in that expedition, and his resolute and indomitable confidence banished those phantoms which otherwise would have darkened the long and weary months of expectation and of silence. Sir Clements Markham, I ask you to accept this cup. It bears this inscription—

> "Presented to Sir Clements Markham, K.C.B., F.R.S., President of the Royal Geographical Society, by the relatives of the Officers and Scientific Staff of the Antarctic ship *Discovery*, in recognition of his unwearying care for the welfare and safety of the Officers and Crew of that ship."

We trust, Sir Clements Markham, that this cup will remind you in years to come, which we all hope will be long, prosperous, and full, of the abiding and affectionate gratitude which we all feel to you for the unwearying and unceasing care which you took, during those months, to provide for the safety and welfare of this ship. I have one more duty to perform. I ask you to convey this small case to Lady Markham. Lady Markham has the pen of a ready writer, and there was no home connected with the men who were on board the ship into which her letters did not penetrate, and it is our wish that this slight memento will, in time to come, remind her of the hope and the confidence which her letters brought with them.

Sir CLEMENTS MARKHAM: When I induced the gallant Antarctic explorers to undertake a dangerous and perilous service, I fully expected, and it would have been perhaps right, that all their relations would have hated and detested me; instead of that, I found nothing from them but kindness and confidence. Many and many are the times in which we have talked and discussed over what should be done, and I cannot help saying how very helpful they were to me, especially in the dispatch of the *Morning*. How hard they worked! How much work they took off my hands! I will not specially mention any one of them, but I was acquainted with them all, and saw them constantly; they were all anxious to help, and in their great anxiety it was my business to comfort them with assurances that the ship was safe, and that she would return. I felt quite certain of that myself, as I told you all last year. And she did come out safely. Most of those relations relied upon me and believed me, and I really think that a great deal of their anxiety was removed by their confidence in me. I did not expect such kindness as is represented by this beautiful present. I shall always look upon this cup, presented to me by the relations of the officers and scientific staff, coupled with the silver sledge which was so kindly presented to me by the officers and men of the *Discovery*, as the two possessions which I shall value most. It will remind me of many happy days, of many conferences which caused anxiety then, but which may now be looked back upon only with pleasure, and they will also serve to remind me of the kindness of the relations and of the gallant conduct of the officers and men. I now convey to Mr. Macartney Lady Markham's expression of thanks, and I am sure she will feel the kindness of her friends as deeply as I have done.

Major L. DARWIN, in proposing the toast of "The Other Guests," said: Sir George Goldie, my lords, and gentlemen, I rise not only to express our pleasure at welcoming a large number of guests here to-night, but also our gratitude to them for attending here on this occasion. This is a banquet given in honour of Sir Clements Markham, whose health we have drunk in a manner so cordial that it must have convinced him—if he needed any convincing—that our expressions of gratitude and good-will to him are very, very real. It was certain that his health would have been drunk with enthusiasm—there was no question about that; but

I think many of us would have felt that this banquet had not been made adequate to the occasion, if we had not succeeded in attracting to our board a large number of distinguished guests. I should like to mention each one of the guests by name, and to thank them for associating themselves with us in endeavouring to do honour to Sir Clements Markham on this occasion, but the number of these guests is too great. Naturally, in the first place, I should wish to welcome those who have come from afar. You will desire me, I am sure, to express on your behalf the most cordial reception possible to M. Cordier, the President of the French Geographical Society, Geography has to recognize the fact of the existence of political boundaries; but I think we English geographers would like to see all boundaries entirely removed from our maps in so far as those boundaries represent lines of demarcation between nations in any way unfriendly to each other. I do not know what M. Cordier's sensations were on crossing the Channel, but I sincerely trust that whatever they were he did not feel, and I am certain he ought not to feel, that he was crossing any such boundary as that which I have alluded to. We will ask M. Cordier to take back to France a message to the effect that we regard his presence here to-night a specially cordial and graceful act. We will ask him to tell our *confrères* in Paris that this act of kindness on his part, as representing them, will be an act we shall not readily forget. I think on this occasion I may also allude to the President of another Geographical Society, although he is not with us to-night—Baron von Richthofen, the eminent President of the Berlin Geographical Society, who writes as follows:—

"The President of the Geographical Society of Berlin, Baron Ferdinand von Richthofen, begs to offer his thanks for the kind invitation of the Vice-Presidents and Council of the Royal Geographical Society to the banquet which is to take place in honour of the retiring President, Sir Clements Markham, on the anniversary of the Society, Monday, May 22. He had entertained the hope to be able to accept it, but, to his most sincere regret, is now prevented by official duties from taking part at the honorary banquet and attending the anniversary of the Society at this particular occasion, when vivid expression will be given to the general admiration and high appreciation of the extraordinary merits which his noble friend has earned, not only as the leader of the pre-eminent Society which has enjoyed the favour of his Presidency for many years, but also for the progress of geographical exploration in general. He desires to make use of this opportunity to offer cordial congratulations, in his own name and in that of the Berlin Geographical Society, to Sir Clements Markham for having crowned the geographical work of his life by personally planning and organizing the glorious British Antarctic Expedition, and choosing in the person of Captain Scott, a commander of the standard of his great predecessors Cook and Ross, and for his having had the good fortune to welcome this expedition on its safe return and to present its memorable achievements in the exploration of the Antarctic continent to his countrymen and to the world at large. In congratulating the Royal Geographical Society for having flourished twelve years under such eminent guidance, he participates in its feeling of regret at the loss it now sustains by the resolution of its high-minded President to resign his office."

I think these words from such an eminent geographer speak volumes, and, I am sure, in your name we may send back a message to him thanking him for his cordial and kindly expressions. There is one other President of a geographical society I must simply mention by name also. He too has crossed a political boundary to come to us. It is a political boundary which he and his compatriots would not see wiped off the map for all the world. I allude to Prof. Geikie, the President of the Scottish Society. These, gentlemen, are peaceful invasions which give us nothing but pleasure; but it must not be supposed that all peaceful invasions give pleasure to the proprietors of the territories invaded. There are certain scientific men who have accused us geographers of the habit of always invading the scientific territories surrounding us, of invading them with a deliberate intention of filching some subject from those territories, and bringing it home and claiming it as exclusively ours. Well, gentlemen, I am not to-night going either to admit or deny this charge, but what I do feel is that these marauding expeditions, if they have taken place, cannot have given rise to any feelings of ill-will, because we have to-night amongst us most distinguished representatives of various societies. We have the honour to have amongst us Sir Thistleton Dyer, Mr. Maw, the President of the Royal Astronomical Society, and Dr. Shaw, our weather prophet, three distinguished gentlemen who represent such divers sciences as botany, astronomy, and meteorology. I presume that the Royal Society, which claims as its sphere the whole universe of science, will not consider that any invasion of its territory can ever take place. I should, therefore, like to associate with the name of Mr. Kempe another peaceful invasion, the extremely successful invasion of the Antarctic Regions which has taken place under the joint auspices of the Royal Society and the Royal Geographical Society. The Royal Society is the mother of all the scientific societies in England, and I presume, therefore, that we Fellows of the Royal Geographical Society may look on the Royal Society as our grandmother. We wish to welcome Mr. Kempe, the Treasurer of that Society, most heartily here to-night. If I have boasted of successful invasions, it must not be supposed that we are always successful in our invasions. We have for many years been endeavouring to force an invasion of geographical teaching within the walls of the various schools and colleges of this country, and we have not been entirely successful in that effort at present. I hope we shall succeed. We shall if we persevere, and I trust that the presence of Sir W. Anson, who is, in fact, our Educational Minister, proves that he is friendly to our endeavours in this respect. At all events, we have amongst us Dr. Gow, the Headmaster of Westminster School, a keen advocate of the teaching of geography in schools. I do not know whether we are right in speaking of the invasion of geography to the field of literature or not, but certain it is that geography is taking a more prominent part in literary work. If I may mention the work of a late Fellow of ours, 'With Edged Tools,' by "Seton Merriman," or to call him by his proper name, Mr. Stowell Scott; or 'The Four Feathers,' by Mr. Mason; you will find that those novels, not only teach their readers a great deal of geography, but they prove that the authors have studied geography in distant countries with the greatest possible care. We are honoured to-night with the presence of Mr. Anthony Hope Hawkins, who has described in the most vivid colours the heroes and half-heroes of our most distant colonies, and we wish to thank him most sincerely for his presence amongst us, because we were exceedingly glad that literature should also be so honourably and so well represented. Many other names I should like to mention. We have amongst us, for instance, the Agents-General for Victoria, New South Wales, Queensland, and New Zealand, and I never can mention these colonies without again and again thanking them for their generous contributions to the Antarctic Expedition. But the thought is forced upon me at the present moment that when I am dining as a guest at a banquet of this sort, nothing pleases me more than that my name should not be mentioned. It requires a very cordial compliment to make up for the anxiety—might I say, the indigestion?—that comes from a sudden call to make an after-dinner speech. I do not know what will be felt by the three gentlemen I have to mention, but if their sensations at all approach my own on a similar occasion, I do trust that they will, at any rate, believe that we mean to pay them the most sincere compliment; and to thank them most heartily for their presence here to-night. Gentlemen, I give you "The Other Guests" of the evening, coupled with the names of M. Cordier, President of the Paris Geographical Society, Mr. A. B. Kempe, and Mr. Anthony Hope Hawkins, with the full certainty that you will drink their health in the most cordial manner.

Prof. H. Cordier: Mr. President, my lords, and gentlemen, I hope I shall be excused if I say but a few words to-night, as I caught a cold two days ago, but I am glad to be able to tell Major Darwin that I had nothing to fear crossing the Channel. The Paris Geographical Society felt they could not hear of a banquet in honour of your retiring illustrious President without being represented by one, at least, of its members. I am proud to be this member, and I bring the tribute of the oldest Geographical Society in the world to Sir Clements Markham. During his presidency the Paris Geographical Society and the Royal Geographical Society have become closer friends. If I may be allowed to say a few words in my own name, they are, that I have known Sir Clements Markham personally for the last ten years, and I have known him by his valuable works for all time. In expressing my regret at his resignation from the administrative work of the Royal Geographical Society, I cherish the hope, and I think not vainly, that there will be some benefit to science, and that your retiring President will have more leisure, and will spend that leisure in scientific research.

Mr. A. B. Kempe: Mr. President, my lords, and gentlemen, I am sure you will concur with me in regretting that the President of the Royal Society has been unable to accept the invitation of the Council of this Society to be present here to-night. He most fully shares in that regret, and has commissioned me to state it is only owing to the impossibility of his being in two places at once that he is not here. He had previously accepted an invitation to be present at the centenary dinner of the Royal Medical and Chirurgical Society, and therefore is unable to be here to do honour to the guest of the evening. I have been asked to speak in his absence as one of those representing the guests, and I certainly have no reason to complain that I have been so asked, for it gives me an opportunity of adding my testimony to that of previous speakers as to the indomitable energy and whole-hearted zeal with which Sir Clements Markham has identified himself with the interests of your great Society. I have not the honour, gentlemen, to be a Fellow of this Society, but for the past five and a half years I have, in conjunction with your Treasurer and Mr. Chalmers, been closely associated with Sir Clements Markham in the financial work of the National Antarctic Expedition. Sir Clements Markham suggested that during all that period we had no serious differences on the Antarctic Finance Committee. Well, we have had Antarctic breezes there, and I am not sufficiently expert in nautical matters to be able to say how many knot breezes they were, but I think they partook very largely of the character of "cats-paws." We very soon got into smooth waters again, and I think those breezes are now forgotten. My services, gentlemen, on that committee have given me opportunities of judging of the way in which Sir Clements Markham does his work, and I have been deeply impressed with the extraordinary zeal and extraordinary skill and extraordinary care about the most minute details, that characterized his work on the Antarctic Expedition. The Antarctic Expedition has been, I believe, the dream of his life, and he certainly has devoted his time and energy, unceasingly, to ensure its success. It is perfectly true, as has been said by Sir George Goldie, that if it were not for Sir Clements Markham that expedition would never have started, and we are indebted to him unquestionably for the large measure of success that has been accorded to it. I have not had the honour, gentlemen, of being associated with Sir Clements Markham in other enterprises, but I should greatly misjudge him if I fancied for one moment that he had not brought the same zeal and the same whole-hearted devotion to the other work which he has done during his tenure of office as President of this Society. We are all glad to learn that he has decided to have a rest, but we very much doubt if he will take it. Now, gentlemen, I have taken this opportunity to say a few words with regard to Sir Clements Markham, but I must not forget that the duty imposed on me to-night is that of acting as one of the mouthpieces of your guests, and I am sure I am speaking the mind of them all in saying how greatly we appreciate the honour you have done us in asking us to participate in your recognition of Sir Clements Markham's work, and how much we thank you for the entertainment you have given us to-night. You, Mr. President, have been so recently appointed, that I think it hardly decent for me to say how greatly we should enjoy being invited to another banquet of the same sort; but I think we may very properly express our assurance that you will during your term of office certainly do all you can to maintain, and will successfully maintain, the progress of the Society which owes so much to your predecessor whom we are specially met to-night to honour. Gentlemen, I thank you on my own behalf and that of the other guests for the cordial manner in which you have drunk this toast.

Mr. ANTHONY HOPE HAWKINS: Mr. President, my lords, and gentlemen, I venture to think that you, sir, passed rather lightly over that episode of Sir Clements Markham's career in what you referred to as the quasi-historical romance. I can only say that if Sir Clements Markham had been desiring a foretaste of Arctic Regions, he could not do better than begin by writing a first novel. As I look deeper into the reasons why I have the honour of being here to-night, I confess that to me they are inscrutable, unless I trace them back to the ancient relation there is between exploration and fiction. Many of the greatest novelists have purported to be explorers; many of the greatest explorers have been accused of being novelists. So we have our friendship, gentlemen. We have our enmities too. Every now and then you take away from us the regions which have been our own. The top of the highest mountains Sir Martin Conway does not hesitate to say he has climbed; Sir Frank Younghusband actually goes to Lhasa, a place which we thought was our own through all eternity. I have not myself, like my friend Mr. Mason, who has been to Morocco, and my friend Mr. Wells, who has been to the Moon, been a great traveller. There may be one or two countries which we have invented which you will never find. But I do not think that the voice of literature, even in the person of a very humble exponent of its most humble and merely recreative form, should be absent to-night, because, to my thinking, there is no more charming form of literature than a good book of travel or exploration. Your Society, gentlemen, and the work that you inspire, are the truest pioneers, not only of what we call civilization, but what we know to be knowledge. You not only open new empires of the physical globe, but you open new spheres of intellectual and speculative thought. With every new land that is traversed by one of your expeditions, with every new sea that is crossed by one of your ships, there comes, too, new knowledge of the nature and history and thought of other lands, transforming inevitably and enormously, as the years go by, our conception of the life and the state of man. And of that great work—and I do not know, without speaking the language of compliment, that there is a greater—the man whom we are here to-night to honour has been the leading spirit and the inspirer. I confess I should count it a great honour and a great privilege to come here to-night as a silent guest, but it is a greater to be privileged to say these few words in honour of a science which seems to me to combine all the good there is in all sciences, and of a man who is most deservedly honoured to-night, and who, I think, must carry away with him what is to any man the sweetest of all praises—the applause of his fellow-craftsmen.

Sir Thomas Holdich proposed the toast of the Medallists and the recipients of the Society's other awards, which was responded to by Sir Martin Conway.

Mr. Edward L. S. Cocks proposed the toast of "The President," to which Sir George Goldie briefly responded, and the proceedings terminated by the company singing "Auld Lang Syne."

Fifteenth Meeting, June 5, 1905.—The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

ELECTIONS:—*Clifford Harold Brookes, M.D.; Henry Algernon Cholmley Darley; Captain Gilbert Robertson Frith, R.E.; Captain Eric Francis Hausburg (R. Lancashire Regt.); Dean C. Worcester.*

THE NEW PRESIDENT.

The PRESIDENT, the Right Hon. Sir GEORGE TAUBMAN GOLDIE, said: Our special business to-night is to hear and discuss Colonel Massy's paper, and, in the ordinary course, I should at once introduce him to the meeting, and call upon him to begin. But the kind way that you have received me reminds me, if indeed I need reminding, that, although during the nine years I was Vice-President I have occasionally taken this chair vicariously, this is the first time I have occupied it as President of the Society; and perhaps you may expect me to say just a few words in honour of that occasion. Need I tell you that I am very proud to have had entrusted to me this leading part in the administration of a great Society, which has not only rendered incalculable services to geography, but in doing so has indirectly promoted the interests of many other sciences. Nor can I forget the great services that the Royal Geographical Society has done, indirectly also, on behalf of the empire; nor again can I forget the long list of illustrious men, able and distinguished, who have preceded me in this chair, and I feel it a special honour to have been called upon to succeed to that great geographer, our twelve years' President, Sir Clements Markham. You will not, of course, expect that I can even approach him in performing my duties as President; that is out of the question. He has given to this subject, geography, and to the interests of the Society a whole lifetime, and he has, of course, performed his duties in a way that I think no other living man could perform them. But although I cannot rival him, you have a right to expect from me that I should perform my duties to the utmost of my powers, and I can, at any rate, promise you that your expectation shall not be disappointed. I think that is all I have to say on the personal question.

The paper read was:—

"Exploring Journeys in Asia Minor." By Colonel P. H. H. Massy.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. *Z. Deutsch. u. Österreich. Alpenv.* **35** (1904): 1–17. **Blaas.**
Struktur und Relief in den Alpen. Von J. Blaas. *With Profiles.*

Alps. *Z. Deutsch. u. Österreich. Alpenv.* **35** (1904): 77–87. **Reishauer.**
Italienische Siedlungsweise im Gebiete der Ostalpen. Von H. Reishauer.

Alps—Cartography. *Z. Deutsch. u. Österreich. Alpenv.* **35** (1904): 18–29. **Oberhummer.**
Die Entwicklung der Alpenkarten im 19. Jahrhundert. Von E. Oberhummer. III. Teil. Die Schweiz. *With Maps.*

Austria. *Meteorolog. Z.* **22** (1905): 113–119. **Topolansky.**
Einige Resultate der 20-jährigen Registrierungen des Regenfalles in Wien. Von Dr. M. Topolansky.

Austria—Dalmatia. *Deutsch. Rundschau G.* **27** (1905): 211–216. **Gelcich.**
Volkswirtschaftliches aus Dalmatien. Von E. Gelcich. *With Illustration.*

Austria—Dalmatia. *Meteorolog. Z.* **22** (1905): 77–80. **Kerner.**
Messung der täglichen Temperaturbewegung in einem Küstenflusse des Karstes in Dalmatien. Von Dr. F. v. Kerner.

Austria—Istria and Dalmatia. *M.R.R.G. Ges. Wien* **48** (1905): 3–30. **Waagen.**
Fahrten und Wanderungen in der nördlichen Adria. Von Dr. L. Waagen.

Austria—Tyrol. *Quarterly J. Geolog. S.* **61** (1905): 97–141. **Skeats.**
On the Chemical and Mineralogical Evidence as to the origin of the Dolomites of Southern Tyrol. By Prof. E. W. Skeats, D.SC. *Map and Plates.*

Austria—Vienna. *Deutsch. Rundschau G.* **27** (1905): 269–271. **Umlauft.**
Die jüngste Stadterweiterung Wiens. Von Prof. Dr. F. Umlauft. *With Plan.*

Balkan Peninsula. *Le Globe, Mém. S.G. Genève* **43** (1904): 1–93. **Pittard.**
Ethnologie de la Péninsule des Balkans. Par le Dr. E. Pittard. *With Plates.*

Belgium. *B.S. Belge Géologie (Procès-Verbaux)* **18** (1904): 239–240. **Deladrier.**
Un projet de détournement de la Lesse dans la région de Han. Par E. Deladrier.

Bulgaria. *Deutsch. Rundschau G.* **27** (1904): 58–68. **Meinhard.**
Durch das Rilagebirge. Von F. Meinhard, junr. *Illustrations.*

France. *Ann. G.* **14** (1905): 23–35. **Barré.**
Origines tectoniques du golfe de Saint-Malo. Par le Commandant O. Barré. *With Maps.*

France. *C. Rd.* **140** (1905): 466–467. **Bergeron.**
Sur la tectonique de la région située au nord de la Montagne Noire. Note de J. Bergeron.

France—Alps. *Ann. Club Alpin Français* 30 (1903): 439–510. **Helbronner.**
Triangulation géodésique des massifs d'Allevard, des Sept-Laux et de la Belle-Étoile. Par P. Helbronner. *Maps and Illustrations.*

Records the work done in 1903 on behalf of the "Commission de Topographie du Club Alpin," with a view to supplementing the Government survey map.

France—Brittany. *Ann. G.* 14 (1905): 36–51. **Vallaux.**
L'évolution de la vie rurale en Basse Bretagne. Par C. Vallaux.

Noticed in the Monthly Record (*ante*, p. 84).

France—Dauphiné. *Ann. Club Alpin Français* 30 (1903): 416–438. **Ferrand.**
Les premières cartes du Dauphiné. Par H. Ferrand. *With Maps.*

France—Gironde. *Ann. Club Alpin Français* 30 (1903): 388–415. **Durègne.**
La grande montagne de la Teste de Buch. Par E. Durègne. *With Maps and Illustrations.*

"Montagne" is used here in a somewhat special sense, being applied to an area of wooded dunes in the Landes.

France—Glaciers. *Ann. Club Alpin Français* 30 (1903): 537–547. **Favre.**
Commission Française des Glaciers. Observations sur les glaciers du massif de la Vanoise pendant l'été 1903. Par le guide J. A. Favre, de Pralognan. *With Illustrations.*

France—Glaciers. *Ann. Club Alpin Français* 30 (1903): 511–536. **Girardin.**
Commission Française des Glaciers. Observations glaciaires en Maurienne, Vanoise et Tarentaise (21 août—24 Septembre 1903). Par P. Girardin. *With Map and Illustrations.*

France—Pyrenees. *C. Rd.* 140 (1905): 542–545. **Bertrand.**
Sur le rôle des charriages dans les Pyrénées de la Haute-Garonne et de l'Ariège. Note de L. Bertrand.

Germany. *G.Z.* 11 (1905): 114–118. **Fischer.**
Zum ersten Jahrgang des Jahrbuches für die Gewässerkunde Norddeutschlands. Von Dr. K. Fischer.

Intended as a kind of introduction to the year-book, in the preparation of which the writer took part.

Germany—Bavaria. *Globus* 87 (1905): 181–186. **Jaeger.**
Die Chiemseelandschaft. Von J. Jaeger.

Germany—Vistula. *Petermanns M.* 51 (1905): 41–42. **Geinitz.**
Die geologische Geschichte des Weichseldeltas. Von Prof. Dr. E. Geinitz. *With Map.*

Greece. *English Hist. Rev.* 20 (1905): 307–309. **Miller.**
The Name of Navarino. By W. Miller.

Holland—Maas. *B.S.G. Com. Paris* 27 (1905): 44–48. **Zobrist.**
Correction de la Meuse dans les Pays-Bas. Par T. Zobrist.

Iceland and Faroe Islands. *Ymer* 24 (1904): 392–399. **Thoroddsen.**
Hypotesen om en post-glacial Landbro over Island og Færöerne set fra et geologisk Synspunkt. Af T. Thoroddsen.

On a supposed post-glacial land connection between Iceland, the Færoes, etc.

Italy. *B.S.G. Italiana* 5 (1904): 909–930. **Lorenzi.**
Escursioni di geografia fisica nel bacino del Liri. Del Prof. A. Lorenzi. *With Illustrations.*

Italy—Venetia. *Riv. G. Italiana* 12 (1905): 39–43. **Bertolini.**
Di una caratteristica impronta toponomastica e storica della conoide-brughiera della Cellina. G. L. Bertolini. *With Maps.*

On the frequent occurrence of the designation "Tezza" (= cattle-station) in the district in question, and on the absence of "castelli" and walled towns along a line defined by physical characters.

Norway. *Norske G.S. Aarb.* 15 (1903-1904): 14–34. **Reusch.**
Fra Kaafjorden i Lyngen. Af Dr. H. Reusch. *With Sketch-map and Illustrations.*

Norway—Valleys. *Norske G.S. Aarb.* 15 (1903–1904): 1–13. **Reusch.**
Nogle dale med flad bund af fast fjeld. Af Dr. H. Reusch. *With Sketch-map and Illustrations.*

Pyrenees. *Questions Dipl.* 18 (1904): 761–772. **Bégouën.**
A propos des chemins de fer transpyrénéens. Par Comte H. Bégouën.

Russia. *Globus* 87 (1905): 21–27, 37–44. **Adler.**
Die deutsche Kolonie Riebensdorf im Gouvernement Woronesh. Von Dr. B. Adler. *With Plan and Illustrations.*

Spain. *Spelunca* 5 (No. 37) (1904): 69–84. **Dufau.**
Grottes et abîmes du pays Basque. Par C. Dufau.

Spain. **Macleay.**
Mining and Metallurgical Industries of Spain in 1903. Foreign Office, Miscellaneous, No. 623, 1904. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. 34. *Price* $2\frac{1}{2}$*d.*

United Kingdom—Canals. *J.S. Arts* 53 (1904): 40–53. **Lee.**
The British Canals Problem. By A. Lee, J.P.

United Kingdom—Ireland. **Coffey and Praeger.**
P.R. Irish A. 25, Sec. C (1904): 143–200.
The Antrim Raised Beach: A Contribution to the Neolithic History of the North of Ireland. By G. Coffey and R. L. Praeger. *Map and Illustrations.*

Noticed in the Monthly Record for May (p. 561).

United Kingdom—Scotland. *Scottish G. Mag.* 20 (1904): 628–640. **Murray and Pullar.**
Bathymetrical Survey of the Fresh-water Lochs of Scotland. Part vi. The Lochs of the Ewe Basin. Under the Direction of Sir John Murray, K.C.B., etc., and L. Pullar. *With Index-map and Illustrations.*

United Kingdom—Scotland. **Smith.**
Scottish G. Mag. 20 (1904): 617–628; 21 (1905): 4–23, 57–83.
Botanical Survey of Scotland. iii. and iv. Forfar and Fife. By W. G. Smith, B.SC., etc. *With Maps and Illustrations.*

ASIA.

Asia. *Deutsch. Rundschau G.* 27 (1905): 225–226. **Webersik.**
Der Brief- und Postkartenverkekr Asiens im Jahre 1902. Von G. Webersik. *Map.*

Japan stands easily at the head of the list with 15·3 letters or postcards per head of population, Kiau-chou next with 10·6, and the Straits Settlements third with 9. The high figure for the second is of course easily accounted for, and for the third also, if the purely native territories are not included; but as round numbers only are given in this case, the result is, perhaps, not entirely to be trusted.

China. *A travers le Monde* 11 (1905): 69–70. **Foy.**
La Mission de M. Maximilien Foy en Extrême-Orient. Projets de Voies ferrées en Chine. *Map.*

The writer advocates, in addition to lines from north to south and east to west with their centre at Hankow, such as are already partially in exploitation, a trunk line from Peking to Cheng-tu, and so to Yunnan and Tongking.

Chinese Empire—Tibet. *National G. Mag.* 16 (1905): 27–38. ———
Views of Lhasa. *Illustrations.*

Reproductions of photographs taken by Tsibikoff and Narzunoff.

Eastern Asia. *Ann. Hydrographie* 33 (1905): 61–66. **Herrmann.**
Die russischen hydrographischen Arbeiten im Stillen Ozean. Nach dem Bericht des Oberst M. Schdanko von J. Herrmann.

Eastern Asia. *G.Z.* 11 (1905): 51–55. **Regel.**
Das ostasiatische Küstenland zu Beginn des Jahres 1904. Von Dr. A. Regel.

India. **Longe.**
Extracts from Narrative Reports of the Survey of India for the season 1902–1903. Prepared under the direction of Lieut.-Colonel F. B. Longe. Calcutta, 1905. Size $13\frac{1}{2} \times 8\frac{1}{2}$, pp. 84. *Index Map. Price* 2*s.* 3*d.*

Includes notes on the survey of the Sambhar salt-lake in Rajputana.

India. **Nevill.**
[District Gazetteers of the United Provinces of Agra and Oudh. Compiled and Edited by H. R. Nevill.] Vol. 3, Muzaffarnagar (pp. 332, xxxviii., xiv., and vi.); vol. 4, Meerut (pp. 316, xlviii., and viii.); vol. 5, Bulandshahr (pp. 314, xxxviii., and vi.); vol. 37, Lucknow (pp. 2, 268, xxxiv., and vi.); vol. 38, Unao (pp. 252, xl., and vi.); vol. 45, Bahraich (pp. 222, xliv., and vi.); vol. 46, Sultanpur (pp. 212, xlii., and vi.). Allahabad, 1903–4. Size 9 × 5½. *Maps. Presented by the India Office.*

India—Botany. *Records Botan. Surv. India* 3 (1905): 143–340. **Prain.**
The Vegetation of the Districts of Hughli-Howrah and the 24-Pergunnahs. By D. Prain. *With Map.*

India—Himalaya. *Scottish G. Mag.* 21 (1905): 173–182. **Freshfield.**
The Sikhim Himalaya. By D. W. Freshfield. *With Illustration.*

India—Himalayas. *Z. Deutsch. Österreich. Alpenv.* 35 (1904): 88–104. **Pfannl.**
Eine Belagerung des Tschogo-Ri (K_2) in der Mustaghkette des Hindukusch (8720 *m.*). Von Dr. H. Pfannl. *With Illustrations.*

India—Railways. ———
Administration Report on the Railways in India for the Calendar Year 1903. London: Eyre & Spottiswoode, 1904. Size 13½ × 8½, pp. iv. and 330. *Map and Diagram. Price* 3*s.* 8*d.*

India—Sikkim. *J.S. Arts* 53 (1905): 264–273. **Freshfield.**
The Gates of Tibet. By D. W. Freshfield. *With Map.*

Indian Ocean—Maldive and Laccadive Islands. **Gardiner.**
The Fauna and Geography of the Maldive and Laccadive Archipelagoes. Edited by J. S. Gardiner. Vol. 2, Part iv., and Supplement 1. Cambridge: University Press, 1905. Size 11½ × 9, pp. 807–921, 923–1040. *Plates. Price* 15*s. net each part.*

Japan. ———
Japan and the Japan Mission of the Church Missionary Society. Fourth Edition. London: Church Missionary Society, 1905. Size 7½ × 5½, pp. viii. and 182. *Map and Illustrations. Price* 2*s. net. Presented by the Church Missionary Society.*

AFRICA.

Abyssinia. *La G., B.S.G. Paris* 11 (1905): 66–70. **Le Roux.**
Reconnaissance du lac Zouaï, de ses îles et de ses archives. Par M. Hugues Le Roux.

See note in Monthly Record for June (p. 676).

Africa. *G.Z.* 11 (1905): 1–18. **Dove.**
Grundzüge einer Wirtschaftsgeographie Afrikas. Von Prof. Dr. K. Dove.

Africa. *C. Rd.* 140 (1905): 349–350. **Lapparent.**
Sur l'extension des mers crétacées en Afrique. Note de A. de Lapparent.

British Central Africa. ———
British Central Africa Protectorate. Diary, 1905. With Official Handbook on the Protectorate compiled in the Secretariat, B.C.A.A., Zomba. Size 10½ × 8½, pp. 64.

British East Africa—Railway. ———
Africa. No. 16 (1904). Report on the Construction and Working of the Mombasa-Victoria (Uganda) Railway and Steamboat Service on Lake Victoria, 1903–1904. London: Wyman & Sons, 1905. Size 13½ × 8½, pp. 40. *Price* 4½*d.*

Cape Colony. **[Gill.]**
Report of His Majesty's Astronomer at the Cape of Good Hope to the Secretary of the Admiralty for the year 1903. London: Printed by Eyre & Spottiswoode, 1904. Size 12½ × 10, pp. 24.

Cape Colony. **Schwarz.**
Index to the Annual Reports of the Geological Commission for the years 1896–1903. Compiled by E. H. L. Schwarz. Cape Town, 1904. Size 10 × 7½, pp. 52. *Presented by the Geological Commission, Cape of Good Hope.*

Central Africa. *Deutsch. Rundschau G.* 27 (1905): 204–211. **Müller.**
Die Salzversorgung Zentralafrikas. Von Dr. C. Müller.

Congo State. *Mouvement G.* 22 (1905): 91–93. **[Wauters.]**
Thysville. *With Illustrations.*
This name has been given to Sona-gongo, on the railway to Stanley pool.

East Africa—Languages. **Hinde.**
Vocabularies of the Kamba and Kikuyu Languages of East Africa. By H. Hinde. Cambridge: University Press, 1904. Size 7½ × 5, pp. xviii. and 76. *Price 3s. net. Presented by the Publishers.*

German East Africa. *Deutsch. Kolonialzeitung* 22 (1905): 73–74. **Schloifer.**
Die Saline Gottorp der Central-Afrikanischen Seeen-Gesellschaft m. b. H. Von O. Schloifer. *With Illustrations.*
These salt works are in Uvinza, east of Ujiji.

German East Africa. *M. Deutsch. Schutzgeb.* 16 (1903): 253–263. **Stolowsky.**
Erkundung der Wegeverhältnisse zwischen der Station Mahenge und Kungulio am Ulanga. Von Dr. Stolowsky. *With Map.*

German South-West Africa. **Hesse.**
Z. Kolonialpolitik 6 (1904): 899–950; 7 (1905): 1–48, 89–154.
Die Schutzverträge in Südwestafrika. Von Dr. H. Hesse.
On the agreements with native chiefs recognizing German authority.

Gold Coast. **Morris.**
Northern Territories of the Gold Coast. Report for 1903. Colonial Reports, Annual No. 429, 1904. Size 10 × 6½, pp. 22. *Price* 1½*d.*

Madagascar. *B.S.G. Lille* 42 (1904): 365–395. ———
Madagascar. L'Inauguration du Chemin de fer de Tananarive à la Mer. *With Map and Illustrations.*

Madagascar. *La G., B.S.G. Paris* 10 (1904): 339–350. ———
Le Chemin de fer de Madagascar. *With Map.*

Morocco. *Renseignements Colon., Comité l'Afrique Française* (1904): 285–293. ———
Quelques mots sur les confréries religieuses marocaines.

Morocco. *Renseignements Colon., Comité l'Afrique Française* (1905): 17–35. **Regnault.**
Le Cours moyen de l'Oued Dra. Par Capitaine Regnault. *With Map.*
Noticed in the Monthly Record for June (p. 565).

Morocco—Meteorology. *Meteorolog. Z.* 21 (1904): 334–335. **Hann.**
Resultate der meteorologischen Beobachtungen zu Marakesch (Marokko) 1900 und 1901. Von J. Hann.

Nigeria. *J. African S.* 4 (1905): 206–225. **Darker.**
Niger Delta Natives, with special reference to maintaining and increasing the population of Southern Nigeria. By G. F. Darker. *With Maps and Illustrations.*

Rhodesia—Ruins. *Norske G.S. Aarbog.* 15 (1903–1904): 142–174. **Skattum.**
Ophir, Bibelens guldland og Syd-Afrikas ruiner. Af O. J. Skattum. *With Map and Illustrations.*

Sahara. *C. Rd.* 140 (1905): 46–47. **Foureau and Gentil.**
Sur les roches cristallines rapportées par la Mission Saharienne. Note de F. Foureau et L. Gentil.

Senegal. *B.S.G. Lille* 43 (1905): 58–62. **Mazeran.**
Navigabilité du fleuve Sénégal. Compte-rendu du Rapport de M. le Lieut. Mazeran.
See note in the *Journal* for January (p. 93).

Somaliland. *J.R. United Service I.* 49 (1905): 169–182. **Owen.**
The Somaliland. Operations, June, 1903, to May, 1904. By Major F. C. Owen. *With Maps.*

South Africa—Rainfall. *T.S. African Philosoph. S.* 15 (1904): 1–28. **Sutton.**
An Introduction to the Study of South African Rainfall. By J. R. Sutton. *With Index-Map and Tables.*

South Africa—Zambesi. *Globus* 87 (1905): 5–12. **Schütze.**
Die Handelszonen des Sambesi. Von W. Schütze. *Illustrations.*

South-West Africa—Boundaries. *Deutsch. Kolonialzeitung* 22 (1905): 4–5. **Hermann.**
Der "Caprivizipfel" und seine Nachbargebiete in den internationalen Verträgen. Von Dr. R. Hermann.

On the international agreements affecting the delimitation of the north-east corner of German South-West Africa.

Togo. *Deutsch. Kolonialzeitung* 21 (1904): 406. ———
Die neue Westgrenze von Togo. *Map.*

Transvaal—Mining. ———
Transvaal Mines Department. Annual Report of the Government Mining Engineer for the year ending June 30, 1904. Part ii. Size 13½ × 8½. *Map, Plans and Diagrams.*

Tripoli. *Monthly Rev.* 18 (1905): 90–106. **Hogarth.**
Cyrenaica. By D. G. Hogarth. *With Plates.*

Tripoli. *La G., B.S.G. Paris* 10 (1904): 363–370. **Mathuisieulx.**
Troisième Mission en Tripolitaine (1901). Par H. M. de Mathuisieulx. *With Map.*

NORTH AMERICA.

Alaska. *B. American G.S.* 37 (1905): 26–40. **Brooks.**
The Investigation of Alaska's Mineral Wealth. By A. H. Brooks. *With Map.*

Canada. *J. Geology* 12 (1904): 722–743. **Ogilvie.**
The effect of Superglacial Débris on the advance and retreat of some Canadian Glaciers. By I. H. Ogilvie. *With Map and Illustrations.*

Canada—Bay of Fundy. *National G. Mag.* 16 (1905): 71–76. ———
Tides in the Bay of Fundy. *With Illustrations.*

Canada—New Brunswick. *B. Nat. Hist. S. New Brunswick* 5 (1905): 299–313. **Ganong.**
Notes on the Natural History and Physiography of New Brunswick. Nos. 81–88. By W. F. Ganong. *With Maps and Illustration.*

Canada—New Brunswick. **Ganong.**
A Monograph of the Origins of the Settlements of New Brunswick. By W. F. Ganong. (From the Transactions of the Royal Society of Canada. Second Series, 1904–1905. Vol. x., section ii.) Ottawa: J. Hope & Sons, 1904. Size 9½ × 6½, pp. 186. *Maps and Diagram.*

North America—Meteorology. *Monthly Weather Rev.* 32 (1904): 461. **Odenbach.**
An Index of Meteorological items in the Jesuit Relations. By Rev. F. L. Odenbach, S.J.

North and Central America. **Ridgeway.**
B. United States Nat. Museum, No. 50 (1904): pp. xx. and 802.
The Birds of North and Middle America. By R. Ridgeway. Part iii. *With Illustrations.*

United States. *Dep. Commerce and Labor, Bureau Census*, B. 14 (1904): pp. 52. ———
Proportion of the Sexes in the United States. *With Maps.*

The proportion of the sexes about 1900 in the United States as a whole was 51·1 male to 48·9 female. While in the country the male excess had become accentuated since 1890, in the towns it had given place to an excess of females.

United States—New Jersey. *Popular Sci. Monthly* 66 (1905): 281–286. **Smith.**
The Mosquito Investigation in New Jersey. By Prof. J. B. Smith. SC.D. *With Illustrations.*

United States—Railways. **Collier.**
United States Railways. Foreign Office, Miscellaneous, No. 627, 1905. Size 9½ × 6, pp. 46. *Price* 2½*d.*

United States—Rice Industry. **Bell.**
Rice Industry in the United States, Foreign Office, Miscellaneous, No. 625. 1905. Size 9½ × 6½, pp. 26. *Price 2d.*

United States—Roads. *B. American G.S.* **36** (1904) : 721–735. **Brigham.**
Good Roads in the United States. By A. P. Brigham.

Shows how bad roads have handicapped the American farmers. Their improvement is now held to be merely a matter of time.

United States—Sierra Nevada. *Sierra Club B.* **5** (1905): 211–220. **Gilbert.**
Domes and Dome Structure of the High Sierra. By G. K. Gilbert. *With Illustrations.*

Noticed in the Monthly Record for April (p. 461).

United States—Telegraphs. *National G. Mag.* **15** (1904): 490–494. ———
The United States Government Telegraph and Cable Lines. *With Maps.*

Extracts from a report by General Greely dealing with the newly opened telegraph lines of Alaska and the Philippines. The maps (which bring out clearly the configuration of the countries) include one of Porto Rico.

CENTRAL AND SOUTH AMERICA.

Argentine Republic—Andes. **Hauthal.**
Z. Deutsch. u. Österreich Alpenv. **35** (1904): 30–56.
Gletscherbilder aus der argentinischen Cordillere. Von Prof. R. Hauthal. *With Illustrations.*

Bolivia. *B.S.G. Com. Paris* **26** (1904): 614–619. **Courty.**
Sur les hauts plateaux de Bolivie, le sol et ses habitants. Par G. Courty.

Bolivia and Brazil. **Posnansky.**
Campaña del Acre, La Lancha "Iris," Aventuras y Peregrinaciones. Por A. Posnansky. La Paz, 1904. Size 9 × 6½, pp. 112. *Map and Illustrations.*

Brazil—Migration of Butterflies. *B. Museu Goeldi* **4** (1904): 309–316. **Goeldi.**
Grandiosas migrações de borboletas no valle Amazonico. Pelo Prof. Dr. A. E. Goeldi. *With Illustrations.*

Brazil—Zoology. *B. Museu Goeldi* **4** (1904): 375–406. **Huber.**
Notas sobre a patria e distribuição geografica das arvores fructiferas do Parà. Pelo Dr. J. Huber.

Martinique. *Science* **21** (1905): 352–353. **Eastman.**
Mont Pelée *sive* Mont Pelé. By Dr. C. R. Eastman.

Justifies the former combination on the ground that Pelée has become a substantival proper name.

Martinique. *C. Rd.* **140** (1905): 694–696. **Forel.**
Le cercle de Bishop de la Montagne Pelée de la Martinique. Note de F. A. Forel.

West Indies. *Mem. y Rev. S. Ci. "Antonio Alzate,"* **19** (1904): 351–373. **Ballore.**
Les relations sismico-géologiques de la Méditerranée Antillienne. Par F. de Ballore. *With Map.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. *Deutsche Rundschau G.* **27** (1905): 162–166. **Grüner.**
Eine neue transkontinentale Eisenbahn. Von W. Grüner.

On the recent decision to link the northern and southern lines across Central Australia.

Australia—Botany. **Banks and Solander.**
Illustrations of Australian Plants collected in 1770 during Captain Cook's Voyage round the World in H.M.S. *Endeavour*. By the Right Hon. Sir J. Banks, Bart., and Dr. D. Solander, F.R.S. With Determinations by J. Britten. [Part iii.] London: Longmans & Co., 1905. Size 19½ × 13, pp. 77–102. *Charts and Plates. Presented by the British Museum.*

This part completes the volume (Cf. *Journal*, vol. **16**, p. 254 ; vol. **18**, p. 337).

British New Guinea. ———
British New Guinea. Annual Report for the year ending June 30, 1903. Size 13½ × 8½, pp. 66.

Caroline and Marianne Islands. *Petermanns M.* **51** (1905): 36–39. **Seidel.**
Die Bevölkerung der Karolinen und Marianen. Von H. Seidel.

Dutch New Guinea. **Hille.**
Tijds. K. Ned. Aard. Genoots. Amsterdam **22** (1905): 233–330.
Reisen in West-Nieuw-Guinea. Door J. W. van Hille. *With Map.*

Besides the information collected during the writer's own journeys, this contains some general information on the western part of Dutch New Guinea, and past Dutch relations with it.

Marianne Islands—Guam. *Petermanns M.* **51** (1905): 40-41. **Supan.**
Die Insel Guam. Von Prof. Dr. A. Supan. *With Map.*

The first of a series of papers (with maps) intended to supply accurate information in regard to *islands*, which cannot, as a rule, be adequately represented in our atlases.

POLAR REGIONS.

Antarctic. *Scottish G. Mag.* **21** (1905): 207-210. **Brown.**
Argentine Antarctic Station. By R. N. Rudmose Brown.

Antarctic. *Quarterly J.R. Meteorolog. S.* **31** (1905): 1-14. **Royds.**
Meteorological Observing in the Antarctic Regions. By Lieut. C. W. R. Royds. *Maps and Illustrations.*

Antarctic—Graham Land. *Ymer* **24** (1904): 371-391. **Duse.**
Om Kartan öfver Graham Land. Af S. A. Duse. *With Maps.*

A sketch of the history of the cartography of Graham's Land.

Antarctic—Swedish Expedition. *Norske G.S. Aarb.* **15** (1903-1904): 83–98. **Andersson.**
De vetenskapliga arbetena ombord på Antarctic sommaren 1902–1903 och slädfärden till Snow Hill 1903. Af J. G. Andersson.

Antarctic—Swedish Expedition. *Norske G.S. Aarb.* **15** (1903-1904): 96–108. **Larsen.**
Antarctics sidste Færd. Af Kapt. C. A. Larsen. *With Illustration.*

Antarctic—Swedish Expedition. **Nordenskjöld.**
La G., B.S.G. Paris **10** (1904): 351-362.
Résultats scientifiques de l'expédition antarctique Suédoise (1901-1903). Par O. Nordenskjöld. *With Illustrations.*

Antarctic—Swedish Expedition. **Nordenskjöld.**
Norske G.S. Aarb. **15** (1903-1904): 56–82.
Den svenska sydpolarexpeditionen 1901–03. Af Dr. O. Nordenskjöld. *With Map and Illustrations.*

Arctic. *Norske G.S. Aarb.* **15** (1903-1904): 129-141. **Isachsen.**
Rundt Ellef og Amund Ringnes's lande. Af G. Isachsen. *With Map.*

Arctic. *Smithsonian Rep.*, 1903 (1904): 427-457. **Peary.**
North Polar Exploration: Field Work of the Peary Arctic Club, 1898-1902. By Commander R. E. Peary. *With Map and Illustrations.*

From the manuscript account as read before the Peary Arctic Club.

Arctic—Norsemen. *La G., B.S.G. Paris* **10** (1904): 371-376. **Isachsen.**
Découverte de vestiges nordiques dans l'archipel polaire américain. Par G. Isachsen. *With Map and Plans.*

The members of the second Norwegian Polar Expedition discovered, on two islets in Cardigan strait and Jones sound, small erections of three stones built for the purpose of sheltering the nests of the eider duck. They were of precisely the same character as are still put up for the same purpose in Northern Norway, and the writer attributes their erection to the early Norsemen.

Franz Josef Land—Meteorology. *Meteorolog. Z.* **21** (1904): 547-555. **Hann.**
Einige Ergebnisse der meteorologischen Beobachtungen auf Franz Josefs-Land zwischen 1872 und 1900. Von J. Hann.

Greenland. *Arkiv Matematik, etc., K. Svensk. Vet.-A.* **1** (1904): 609–626. **Åkerblom.**
Expédition de M. A.-G. Nathorst en 1899. Déterminations magnétiques faites au Grönland du nord-est. Par F. Åkerblom.

MATHEMATICAL GEOGRAPHY.

Cartography. **Vasconcellos.**
Sociedade de Geographia de Lisboa. Exposição de Cartographia Nacional (1903-1904). Catalogo sob a direcção de Ernesto de Vasconcellos. Lisboa, 1904. Size 9½ × 6½, pp. xxxiv. and 280.

Figure of the Earth. *Ciel et Terre* **25** (1904): 401–416. **Puiseux.**
La notion de la figure de la Terre, de Thalès à Newton. Par P. Puiseux.

Geodesy. *Petermanns M.* **51** (1905): 42–43. **Hammer.**
Ausgleichung des europäischen Längennetzes. Von Prof. Dr. E. Hammer.

Longitude Determination. **Smith.**
Rep. U.S. Coast and Geodetic Surv. (1904), Appendix 4: 257–311.
Telegraphic Longitudes. The Pacific Arcs from San Francisco to Manila, 1903-1904. By E. Smith. *With Map and Illustrations.*

Surveying. *P.I. Civil Engineers* **158** (1904): 361–368. **Crosthwaite.**
Note on Traverse Surveying. By P. M. Crosthwaite.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climate and Morphology. *American J. Sci.* **19** (1905): 165–174. **Penck.**
Climatic Features in the Land Surface. By A. Penck.

Cosmogony. *Petermanns M.* **51** (1905): 43–45. **Friedel.**
Zur Kant-Laplaceschen Theorie. Von J. Friedel.

Geology and Earthquakes. **Ballore.**
B.S. Belge Géologie (*Mém.*) **18** (1904): 243–268.
Géosynclinaux et régions à tremblements de terre. Esquisse de géographie sismico-géologique. Par F. de Montessus de Ballore.

Geomorphology. *Ann. G.* **13** (1904): 385–400. **Martonne.**
Les enseignements de la topographie. Par E. de Martonne. *Maps.*

Geomorphology. **Passarge.**
Rumpfflächen und Inselberge, von — Passarge. (Sonder-Abdruck aus dem Dezember-Protokoll der Deutschen geologischen Gesellschaft, Bd. 56, Jahrg. 1904.) Berlin. Size 9 × 6, pp. 193–209.

Meteorology. *Meteorolog. Z.* **21** (1904): 324–326. **Hann.**
Ueber die Temperaturabnahme mit der Höhe bis zu 10 km. nach den Ergebnissen der internationalen Ballonaufstiege. Von — Hann.

Meteorology. *Meteorolog. Z.* **21** (1904): 453–458. **Homma.**
Beiträge zur Kenntnis der Temperaturverteilung in der Atmosphäre und ihrer Beziehung zur Witterung. Von J. Homma.

Meteorology. **Marchi.**
Manuali Hoepli. Meteorologia generale, di L. De Marchi. 2ª Edizione. Milano, U. Hoepli, 1905. Size 6 × 4, pp. xiv. and 226. *Maps and Illustrations. Price L*1.50. *Presented by the Publisher.*

Like the other manuals issued by the same publisher, this forms an exceedingly compact and handy summary of the main principles of the science with which it deals.

Oceanography. ———
Conseil Permanent International pour l'Exploration de la Mer. Rapports et Procès-Verbaux des Réunions. Volume ii. Juillet 1903—Juillet 1904. Copenhague: A. F. Høst & Fils, 1904. Size 10½ × 8½, pp. xl., 32, and 72.

Oceanography—Waves. *Rev. Maritime* 163 (1904): 19–25. **Jolivet.**
Observations sur les roulis de la "Foudre" dans la Mousson de Sud-est, pendant les journées des 29, 30 et 31 juillet 1904. Par lieutenant Jolivet.

Seismology. *C. Rd.* **139** (1904): 686–687. **Ballore.**
Sur la coïncidence entre les géosynclinaux et les grands cercles de sismicité maxima. Note de M. de Montessus de Ballore.

Seismology. *C. Rd.* **139** (1904): 780–781, 782. **Lippmann.**
Mesure de la vitesse de propagation des tremblements de terre. Note de G. Lippmann. Sur l'inscription des movements sismiques. By the same.

Soil Temperature. *Meteorolog. Z.* 21 (1904): 399–408. **Woeikof.**
Nachtrag zu den Problemen der Bodentemperatur. Von A. Woeikof. *With Diagrams.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropology—Dwarfs. *Globus* 87 (1905): 121–125. **Schmidt.**
Die Grösse der Zwerge und der sogenannten Zwergvölker. Von E. Schmidt.

Historical—Maps. *Riv. G. Italiana* 12 (1905): 1–7. **Gallois.**
Sui mappemondi del Dalorto e dèl Dulcert. Osservazioni di L. Gallois.

Historical—Portuguese in India. **Viterbo.**
O thesouro do Rei de Ceylão. Memoria apresentada á Academia Real das Sciencias do Lisboa. Por S. Viterbo. Lisboa, 1904. Size 12½ × 9, pp. 68. *Presented by the Author.*

Reproduces an inventory, drawn up by Simão Botelho, of the treasure taken from the king of Ceylon during the expedition of Affonso de Noronha.

Sociology. **Galton and others.**
Sociological Papers. By Francis Galton, E. Westermarck, P. Geddes, E. Durkheim, Harold H. Mann and V. V. Branford. With an Introductory Address, by James Bryce. London: Macmillan & Co., 1905. Size 10½ × 7, pp. xviii. and 292. *Price* 10*s*. 6*d*. *Presented by the Sociological Society.*

Consists mainly of papers read before the newly constituted Sociological Society.

BIOGRAPHY.

Andree. *Globus* 87 (1905): 148. **Andree.**
Kurzer Rückblick auf Richard Andrees literarische Tätigkeit. Von H. Andree.

This number of *Globus* is dedicated to Prof. R. Andree on the occasion of his seventieth birthday, a portrait being given.

Claudius Clavus. *Norske G.S. Aarb.* 15 (1903–1904): 109–128. **Bjørnbo.**
Nordens ældste kartograf. Af Dr. A. A. Bjørnbo.

Noticed in the Monthly Record (*ante*, p. 93).

Kirchhoff. *Deutsch. Rundschau G.* 27 (1905): 230–232. ———
Prof. Dr. Alfred Kirchhoff. *With Portrait.*

Philippi. *An. S. Ci. Argentina* 58 (1904): 145–151. **Hicken.**
Doctor Rodulfo Amando Philippi. Breves apuntes biográficos. C. M. Hicken. *With Portrait.*

Obituary of the well-known German naturalist, long settled in Chile.

GENERAL.

Altitude and Respiration. *C. Rd.* 139 (1904): 1115-1117. **Tissot.**
Les phénomènes physiques et chimiques de la respiration aux grandes altitudes.

Geographical Names. *G. Jahrb.* 27 (1) (1904): 113–176. **Nagl.**
Ueber die Fortschritte der geographischen Namenkunde. Von J. W. Nagl.

German Colonies. ———
Jahresbericht über die Entwickelung der deutschen Schutzgebiete in Afrika und der Südsee im Jahre 1903–1904. Mit einem Bande Anlagen. (Beilage zum Deutschen Kolonialblatt 1905.) Berlin: E. S. Mittler und Sohn, 1905. Size 12 × 8½, pp. 114, 494.

Mountaineering. *Sitzb. K.P.A.W. Berlin* (1904): 1041–1042. **Durig and Zuntz.**
Bericht über einige Untersuchungen zur Physiologie des Menschen im Hochgebirge. Von Prof. A. Durig u. Prof. N. Zuntz.

Terminology. *Science* 21 (1905): 28–29. **Gilbert.**
Style in Scientific Composition. By G. K. Gilbert.

Discusses the question of the introduction of new technical terms in physical geography, some of which, *e.g.* "youthful," "mature," etc., the writer upholds.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Bohemia. **Rauchberg.**

Sprachenkarte von Böhmen. Von Dr. Heinrich Rauchberg. Scale 1 : 500,000 or 7·9 stat. miles to an inch. Vienna: R. Lechner, [1905]. *Price* 4*k*. 50*h*.

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from May 1 to 31, 1905.

2 miles to 1 inch:—

Printed in colours, folded in cover or flat in sheets, (38 and part of 39). *Price*, on paper, 1*s*. 6*d*.; mounted on linen, 2*s*.

36, 37, 46. *Price*, on paper, 1*s*. *each*; mounted on linen, 1*s*. 6*d*. *each*.

1 inch:—

(Third edition), in outline, 16, 24, 26, 235, 273, 304. 1*s*. *each* (engraved).

(Third edition), with hills in brown or black, 13, 14, 18, 21, 25. 1*s*. *each* (engraved).

6-inch—County Maps (first revision):—

Brecknockshire, 2 S.W., 5 S.W., 16 N.E., S.E., 17 N.E., S.W., 22 N.E., 23 N.W. **Devonshire**, 5 S.W., 7 N.E., S.W., S.E. **Gloucestershire**, 3 N.W. **Herefordshire**, 30 N.E., 31 N.W., 34 N.W., S.E., 35 S.E., 37 N.E., 39 N.W., N.E., S.E., 40 N.W., S.E., 45 N.W., N.E., 46 N.W., S.E., 50 N.W., S.E., 51 N.W., 55 N.W. **Lincolnshire**, 139 N.E. **Radnorshire**, 15 S.W., 22 S.W., 32 S.E., 35 N.E., S.E., 36 N.E., S.W., 37 N.W., 38 N.E., 39 N.W. **Somerset**, 83 S.W., 69 S.E., 71 N.W., S.E. **Suffolk**, 43 N.W., N.E., 44 N.E., S.E., 45 N.E., 46 N.W., S.W., S.E., 47 N.W., 48 N.W., N.E., S.W., S.E., 49 N.E., S.W., S.E., 50 N.W. (50 S.E. and 51 S.W.), 56 N.E., 87 N.E., 88 N.W., N.E., S.W., S.E. **Warwickshire**, 9 S.W., 14 N.E., S.E., 15 S.W., 17 S.W., S.E., 19 N.W., 20 N.E., 24 N.W., 30 N.E., 49 N.W. **Worcestershire** (3*a* S.E. and 7 N.E.), 6 N.E., S.E. (7 N.E. and 3*a* S.E.), 7 (S.W. and S.E.), 10 N.W., N.E., S.E., 11 N.W., 12 S.W., 16 N.E., S.E., 17 N.W., 20 N.E., 21 S.W., S.E., 22 S.E., 23 N.E., S.W., 28 N.W., S.W., 29 N.E., 33 N.E., 43 N.W., 47 N.W., S.W. **Yorkshire** (First Revision of 1891 Survey), 286 N.W. 1*s*. *each*.

25-inch—County Maps (first revision):—

Cardiganshire, XI. 13; XII. 14; XIV. 15, 16; XV. 4, 5, 13, 14, 15, 16; XVI. 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 13, 14; XXI. 1, 3, 8; XXII. 5. **Devonshire**, XI. 15; XV. 3, 4, 7, 8; XVI. (1 and 5), 6, 11, 12, 13, 14; XXII. 15; XXIII. 15; XXV. 6, 9, 10, 13, 14; XXVIII. 9; XXIX. 13, 14, 15, 16; XXX. 13, 15, 16; XXXI. 15, 16; XXXV. 2; LIV. 6, 7, 8, 10, 11, 12; LXVII. 14, 15, 16; LXVIII. 13, 14, 15, 16; LXXVIII. 6, 7, 8, 10, 11; LXXIX. 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 13, 15, 16; LXXXI. 1, 5, 9, 13; XCI. 6, 7; **Lincolnshire**, XCV. 2, 3, 4, 5, 9, 10, 13, 14, 16; XCVI. 1, 2, 3, 4, 5, 7, 8, 10, 11, 12, 13, 14, 15, 16; XCVII. 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16; XCVIII. 1, 5, 7, 8, 10, 11, 12, 14; CVII. 9, 10, 14; CVIII. 1, 2, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15; CXVII. 16. **Norfolk**, LXVIII. 11; LXIX. 7; LXXX. 3, 4; LXXXI. 1, 5, 12, 15, 16; LXXXII. 6, 9, 11, 12, 15, 16; XCI. 3, 4; XCII. 3, 4; XCVI. 1, 2, 3, 4, 7, 8, 12, 16; XCVII. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XCVIII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14; XCIX. 1, 10; CVI. 2, 3, 4; CVII. 1, 2. **Suffolk**, VIII. 6, 7, 8, 10, 12, 14, 16; IX. 10, 13, 14, 15; XVII. 1, 2, 3, 4; XVIII. 1, 2, 3. **Warwickshire**, XXI. 3; XXXI. 7, 13, 14, 15; XXXVII. 1, 2, 3, 5, 6, 7, 9, 10, 11, 15; XXXVIII. 6; XLIII. 1, 2, 3, 11, 15; XLIX. 3. **Yorkshire** (First Revision of 1891 Survey), CCLXXXVIII. 3, 4, 8; CCLXXXIX. 1, 2, 6; CCXCV. 1. 3*s*. *each*.

(*E. Stanford, London Agent.*)

England and Wales. **Geological Survey.**

1-inch maps (New Series). Colour printed.

Newport (Mon.), 149. Drift edition. 1*s*. 6*d*.

(*E. Stanford, London Agent.*)

Europe. **Ebbecke.**

Ebbeckes Verkehrskarte. Scale 1 : 600,000 or 9·5 stat. miles to an inch. Nos.: 8, Provinz Schleswig-Holstein, 7 Auflage; 9, Königreich Sachsen, 7 Auflage; 10, Elsass-Lothringen, 3 Auflage; 11, Grossherzogtümer Mecklenburg-Strelitz, 2

Auflage; 12, Grossherzogtum Hessen, 2 Auflage; 15, Provinz Sachsen und Thüringen, 5 Auflage.—Scale 1 : 2,000,000 or 31·5 stat. miles to an inch. No. 13, Westliche Russland, 3 Auflage.—Scale 1: 450,000 or 7·1 stat. miles to an inch, No. 14, Schweiz, 3 Auflage. Lissa: Friedrich Ebbecke, [1905].

Europe. **International Geological Commission.**

Carte géologique international de l'Europe. Scale 1 : 1,500,000 or 23·7 stat. miles to an inch. Livraison v. Berlin: Dietrich Reimer, 1905. *Presented through the Royal Society, London.*

This is the fifth issue of the geological map of Europe proposed by the International Geological Congress at Bologna in 1881, and executed conformably with the decision of an International Commission, with the approval of the various governments, under the direction of MM. Beyrich, Hanchecorne, and Beyschlag.

With the publication of this part, thirty sheets out of the total of forty-nine, of which this map will finally consist, have been issued. Four of the present sheets, 43 (A VII.), 44 (B VII.), 45 (C VII.), 46 (D VII.), include the North African regions bordering on the Mediterranean, and so are strictly outside the limits of the map, and, for the want of reliable geological data, they must be considered in parts but very approximate. Sheet 27 (F IV.) gives south-east European Russia, including the lower course of the Volga and the Don. The fourth part of the map was published early in 1902.

Europe—Central. **Flemming and Merkel.**

Grosser Atlas der Eisenbahnen von Mittel-Europa. New Bearbeitet und Vervollständigt von M. Flemming und G. Merkel. Herausgegeben von Alexander Duncker, xv Auflage. Leipzig: Verlag für Börsen- und Finanzliteratur, 1905.

The fact that this atlas has now reached its fifteenth edition speaks well for its merits and general utility. It is divided into three sections, the first dealing with the German Empire and Switzerland; the second, Austria-Hungary, Servia, the Balkan Peninsula, Greece, and Italy; and the third with France, Belgium, the Netherlands, Sweden and Norway, Denmark and Russia. The maps showing the railways are most complete in the information they contain, and in addition to these there is an index to places, and statistics in tabular form, amounting altogether to fifty-four pages.

Europe—Central. **Ihne.**

Phaenologische Karte des Frühlingseinzugs in Mitteleuropa. Von E. Ihne Scale 1 : 3,400,000 or 53·6 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1905, Tafel 9. Gotha: Justus Perthes, 1905. *Presented by the Publisher.*

Europe—Central. **K. Preussische Landesaufnahme.**

Topographische Specialkarte von Mittel-Europe. Herausgegeben von der Kartographischen Abtheilungen der Königlichen Preussische Landesaufnahme. Scale 1 : 200,000 or 3·1 stat. miles to an inch. Sheets: 250, Nauen; 251, Berlin; 277, Madgeburg; 629, Walenstadt; 331, Düsseldorf; 383, Valenciennes. Berlin, 1904. *Price* 1·00 *mark each sheet.*

Germany. **Andresen and Bruhn.**

Geographisch-statistische Karten von Deutschland, bearbeitet und gezeichnet von H. Andresen und H. Bruhn. No. 1, Sprachenkarte. Scale 1 : 1,200,000 or 18·9 stat. miles to an inch. Brunswick: Hellmuth Wollermann.

The first of a series of coloured geographical and statistical wall-maps of Germany, suitable for schools. It shows by colouring the general distribution of languages in the German Empire, and is clear and instructive. When complete the series will consist altogether of twelve maps, and ought to be of decided educational value.

Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographischen Abtheilungen der Königlichen Preussische Landesaufnahme. Scale 1 : 100,000 or 1·6 stat. miles to an inch. Sheets: (plain) 295, Furstenwalde; (brown hills and contours) 144, Osten; 174, Varel; 203, Bunde; 209, Amelinghausen; 210, Lüneburg; 238, Uelzen; 262, Celle; 263, Wittingen; 284, Lübbecke; 285, Minden; 286, Hannover; 287, Lehrte; 288, Braunschweig; 309, Lemgo; 310, Hameln; 311, Hildesheim; 312, Wolfenbüttel. Berlin, 1904. *Price* 1·50 *mark each sheet.*

Lake Constance. **Becker.**

Karte von Bodensee und Rhein mit den angrenzenden Gebieten von Baden, Württemberg, Bayern, Österreich und der Schweiz, bearbeitet von Prof. F. Becker. Herausgegeben vom Verein für Geschichte des Bodensee's und seiner Umgebung und dem Bodensee-Verkehrsverein. Scale 1 : 125,000 or 1·9 stat. mile to an inch. Bern: H. Kümmerly & Frey, [1905].

Sweden. **Sveriges Geologiska Undersökning.**

Sveriges Geologiska Undersökning. Series Aa. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Sheets: 119, Sommenäs; 121, Sköfde; 124, Björneborg; 127, Loftahammar; 128, Skagersholm. Series Ac. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheets: 5, Oskarshamn; 8, Mönsterås. Series Ala. Scale 1 : 200,000 or 3·1 stat. miles to an inch. Berggrundskator i Skalan. Sheets 1 and 2.

ASIA.

Dutch East Indies. **Stemfoort and Siethoff.**

Atlas der Nederlandsche Bezittingen in Oost-Indië, naar de niewst Bronnen samengesteld en aan de regeering opgedragen door J. W. Stemfoot en J. J. ten Siethoff, Kapiteins van den Generalen staf van het Nederlandsch-Indisch leger. Gereproduceerd, op last van het Departement van Koloniën, aan de Topographische inrichting te 's Gravenhage, onder leiding van den Directeur C. A. Eckstein. Sheet (new edition) 3, West Java. Scale 1 : 500,000 or 7·9 stat. miles to an inch. The Hague, 1905.

Manchuria. **Favre.**

Le Théatre de la Guerre en Mandchourie d'après la carte militaire russe dressée en 1902 par le Colonel Khvostoff et le Lieut. Lubizky. Croquis publié par le Colonel Camille Favre. Scale 1 : 853,600 or 13·5 stat. miles to an inch. Geneva: Librairie Georg, 1905.

An extremely rough sketch-map of Manchuria in black, taken from the Russian map mentioned below.

Manchuria. **Khvostoff and Lubizky.**

Map of South Manchuria. Mukden District and Kwantung Province. Compiled by Lieut.-Colonel Khvostoff and Lieut. Lubizky. Scale 1 : 840,000 or 13·3. stat. miles to an inch. 4 sheets. St. Petersburg: Military Topographical Department, 1903.

A Russian military map, in colours, of the seat of war in Manchuria and the Kwangtung Province, compiled from information obtained by Russian officers, and now being used in the campaign in the Far East. Inset plans of the principal towns are given.

Manchuria. **Topographical Section, General Staff.**

Map of the country round Mukden. Scale 1 : 420,000 or 6·6 stat. miles to an inch, Revised May, 1905. Map of the country north of T'ieh-ling. Scale 1 : 420,000. Revised May, 1905. Map of the country south of Harbin. Scale 1 : 420,000. May, 1905. London: Topographical Section, General Staff, War Office, 1905. *Price 2s. each. Presented by the Director of Military Operations.*

These maps have been revised and corrected up to date. Hills have also been added.

Siberia. **Topographical Section, General Staff.**

Map of the country round Vladivostok. Scale 1 : 630,000 or 9·9 stat. miles to an inch. London: Topographical Section, General Staff, War Office, 1905. *Price 2s. Presented by the Director of Military Operations.*

Yangtse-Kiang. **Hourst.**

Chine. Haut Yang-tse entre Itchang et Suifou et ses affluents en amont de Suifou d'après le levé fait de 1901 à 1903 sous la direction de M. Hourst, par MM. Bramaud de Boucheron, Térisse, Monnot et Marquis. Scale 1 : 50,000 or 1·3 inch to a stat. mile. 21 sheets and index. Paris: Service Hydrographique de la Marine, 1905. *Price 24 fr.*

A considerable amount of survey work has been carried out in recent years in the upper Yang-tse valley, both by English and French expeditions. Among the former may be mentioned the surveys of Majors Ryder and Davis, and those of Colonel Manifold's expeditions, accounts of which have appeared in the *Geographical Journal.* The present chart has been drawn from surveys made under the direction of Lieut. Hourst and other officers of the French Navy, between the years 1901 and 1903, the positions being deduced from observations taken at Ichang, Chungking, and Suifu by Père Chevalier in 1897 and 1898. The courses of the Hong Kiang, Kincha Kiang from Ping Chan Hien to Koan Che, and of the Fu Ho from Kiating to Kiang Keu, have been laid down from the survey of the English Pilot Plant. The chart consists altogether of twenty-one sheets on the scale of 1 : 50,000, and shows a considerable amount of detailed information concerning the course of the Yang-tse, including sand-banks, direction of currents, and soundings.

AFRICA.

Africa. **"Les Missions Catholiques."**

Carte des Missions Catholiques en Afrique. Scale 1 : 10,000,000 or 157·8 stat. miles to an inch. Supplement to the journal *Les Missions Catholiques*, May 12, 1905. Paris, 1905.

On this general map of Africa the present position of Roman Catholic missionary enterprise is clearly shown. The various bishoprics, vicariats, préfectures and missions are indicated, mission stations being shown by a red line under the name of the place. There are statistical tables at the bottom of the map giving detailed information as to the number of missionaries, schools, etc.

Africa. **Topographical Section, General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheets: 7, Tripoli; 8, Ben-Ghazi; 14, Sella; 15, Aujila; 58 and 70, Freetown; 73, Kotonu. London: Topographical Section, General Staff, War Office, 1904–05. *Price 2s. each sheet. Presented by the Director of Military Operations.*

Africa. **Topographical Section, General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheets: Southern Nigeria, 74-J, 74-N. London: Topographical Section, General Staff, War Office, 1905. *Price 1s. 6d. each sheet. Presented by the Director of Military Operations.*

Assuan Cataract. **Egyptian Survey Dept.**

Map of the First or Assuan Cataract. Scale 1 : 10,000 or 6·3 inches to a stat. mile. 6 sheets. Cairo: Survey Department, Public Works Ministry, 1904. *Presented by the Director-General, Egyptian Survey Department.*

This is a revised edition of the map issued in 1900, which was noticed in the November *Journal* of that year.

German East Africa. **Sprigade and Moisel.**

Karte von Deutsch-Ostafrika. Begonnen unter Leitung von Dr. Richard Kiepert, fortgesetzt unter Leitung von Paul Sprigade und Max Moisel. Scale 1 : 300,000 or 4·7 stat. miles to an inch. Sheet E 3, Rukwa-See. Berlin: Dietrich Reimer (Ernst Vohsen), 1905. *Presented by Herr Max Moisel.*

This sheet includes the region immediately to the north of Lake Rukwa, and extends from lat. 7° S. to 8° 30′ S., and from long. 32° to 34° E. Explorers' routes are shown, and all available information has been utilized, but many districts shown on the sheet are entirely unexplored. The sheet is accompanied by letterpress giving the list of authorities consulted.

Morocco. **Theuveny.**

Carte du Maroc, dressée d'après les documents les plus récents. Scale 1 : 1,500,000 or 23·7 stat. miles to an inch. Paris: Louis Theuveny, [1905]. *Price 1 fr.*

A cheap general map of Morocco, giving a useful explanation of Arabic terms and abbreviations employed.

Togo. **Sprigade.**

Die Umgebung der Station Atakpame, bearbeitet von P. Sprigade. Scale 1 : 100,000 or 1·6 stat. mile to an inch. *Mitteilungen aus den deutschen Schutzgebieten*, Band xviii., Karte 2. Berlin, 1905. *Presented by Herr P. Sprigade.*

AMERICA.

Argentine Republic. **Director-General de Correos y Telégrafos.**

Carta de las Comunicaciones Postales y Telegráficas confeccionada según los datos, observaciones y exploraciones hechas por la Dirección General de Correos y Telégrafos. Scale 1 : 2,225,000 or 35·1 stat. miles to an inch. 3 sheets. Buenos Aires, 1904.

This is an official postal and telegraph map of the Argentine Republic, and upon these matters it contains much information. As a specimen of cartography it is far from satisfactory, and in parts is so confused that the names are almost illegible. This is chiefly owing to the attempt to show the mountains by shading, which in a map of this kind is generally a mistake.

Argentine Republic. **Ministerio de Obras Publicas, Buenos Aires.**

Mapa de los Ferro Carriles de la Republica Argentina. Scale 1 : 2,500,000 or 39·4 stat. miles to an inch. Buenos Aires: Ministerio de Obras Publicas, 1905.

Canada. **Topographical Surveys Branch, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Battleford Sheet (267), west of Third meridian, revised to March 30, 1905. Ottawa: Topographical Surveys Branch, Department of the Interior, 1905. *Presented by the Topographical Surveys Branch, Ottawa.*

Costa Rica. **International Bureau of American Republics.**

Map of Costa Rica from official and other sources. Prepared in the International Bureau of the American Republics, W. W. Rockhill, Director. Scale 1 : 792,000 or 12·5 stat. miles to an inch. Washington, 1903.

One of the series of general maps of Central America published by the U.S. International Bureau of the American Republics. As is the case with the other maps of the series, much useful information is given, especially as regards the navigability of the rivers and mining districts. The boundary between Panama and Costa Rica, as laid down on this map, after running west from Mona Point for about 18 miles, is shown as taking a southerly course, and thus gives to Costa Rica all the upper basin of the Rio Sixola. As regards the topographical features, as much of the country is entirely unsurveyed, a great deal is, of course, hypothetical or most approximate.

Paraguay. **Romero.**

Mapa de la Republica del Paraguay. Por C. Romero. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Asuncion: Departamento General de Ingenieros, 1904.

So much of the Republic of Paraguay still remains unexplored, that on a map on the scale of 1 : 1,000,000 many districts appear entirely blank. Upon the Chaco region to the north-west of the map, with the exception of the green tint with which it is coloured, there is practically nothing shown. However, there are so few maps of Paraguay that any recent one that is at all reliable is welcome. There is a useful plan of Asuncion in the lower left-hand corner of the map.

AUSTRALASIA.

Western Australia. **Dept. of Lands and Surveys.**

Map of Western Australia. Scale 1 : 1,584,000 or 25 stat. miles to an inch. 4 Sheets. Perth: Department of Lands and Surveys, 1903. *Presented by the Agent-General for Western Australia.*

This is a useful general map of Western Australia, compiled from the latest information. It is printed in colours, and shows political divisions, goldfields, explorers' routes, agricultural areas, railways, telegraphs, stock routes, wells, etc. An outline of England and Wales is drawn upon the map to show proportional areas.

GENERAL.

French Colonies. **Mager.**

Nouvel Atlas Colonial. Par Henri Mager. Supplément aux *Colonies Françaises.* Paris: Ernest Flammarion, [1905]. *Price* 3 *fr.* 50.

This atlas includes the maps of Mager's 'Atlas d'Algérie et Tunisie' and the 'Atlas d'Afrique Occidentale' which have before been published separately, with the addition of others of the French colonies, not included before. As a cheap general atlas of the French colonies, it will doubtless be useful. There are altogether thirty-eight sheets of maps, besides numerous inset plans and diagrams in the letterpress.

CHARTS.

Liverpool Bay. **Belam and Ashton.**

Chart of Liverpool Bay. Scale 1 : 36,000 or 1000 yards to an inch. Surveyed by Commander H. Belam, R.N., Marine Surveyor, and H. G. G. Ashton, Assistant

Marine Surveyor, Mersey Docks and Harbour Board. Liverpool, 1904. *Presented by H. G. G. Ashton, Esq.*

This chart has been revised up to date.

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for June, 1905. London: Meteorological Office, 1905. *Price 6d. Presented by the Meteorological Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for June, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Nigeria. **O'Neill.**

104 photographs of Nigeria, taken by Lieut. F. R. O'Neill. *Presented by Lieut. F. R. O'Neill.*

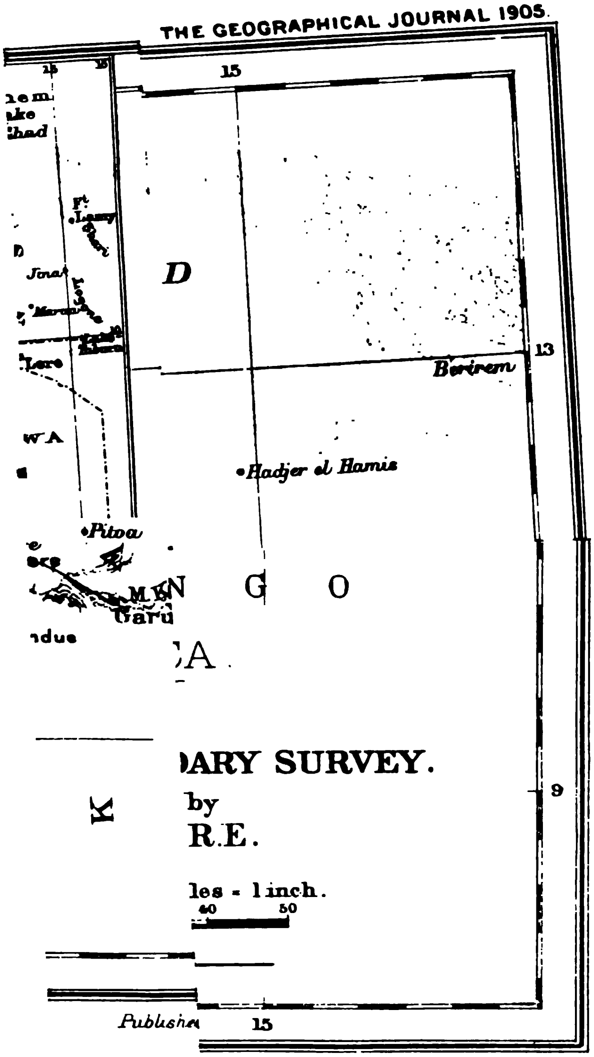
These valuable photographs have been presented to the Society by a son of Consul H. E. O'Neill, of Mozambique, well known to this Society on account of his important geographical explorations in South-East Africa in years past. Lieut. F. R. O'Neill is now serving under General Sir F. Lugard in Northern Nigeria, and in the course of his duties has found time and opportunity to do some good geographical work, to better qualify himself for which he passed through the Society's course of instruction in practical astronomy and surveying last year, and obtained the diploma. The photographs, the titles of which are mentioned below, were taken by Lieut. O'Neill in 1903, during his journeys in the little-known district of Central Northern Nigeria. They are Kodak panoramic views, mounted in albums, and carefully described.

(1) A bush road; (2) A bush village; (3) A bush path; (4 and 5) Carriers crossing stream; (6) The Gurara river; (7 and 8) Ringa; (9) Natives platting grass; (10) Carriers going through thick bush; (11) Crossing river; (12 and 13) Paiko; (14) and 15) Market-place, Paiko; (16) Dye-pits, Paiko; (17) View from hills; (18) View of open country; (19) Camp; (20 and 21) Village near Keffi; (22) Small boy playing "molo;" (23) View inside Keffi; (24) King's palace wall, Keffi; (25–28) On the march; (29) Small village in the bush; (30) A halt in a village; (31) Village street; (32) Camp outside village; (33) Bush; (34) Crossing a village; (35) Men washing in pool; (36) Distant view of hills; (37) Steep mass of rock with perpendicular sides; (38 and 39) Unwalled village; (40) A village in the Gwari country; (41) Village with double wall and ditch; (42) A village built on the summit of a rocky hill; (43–45) Village of Boso; (46) Hausa children; (47) Village divided in compounds by grass-platted walls; (48*a*) Tent in the bush; (49, 52, and 70) Bungalow, Zungeru; (50) Officers' mess, Zungeru; (51) Tennis court; (53) N.C.O.'s bungalow; (54–56) The king of Kano under escort; (57) Recruits drilling; (58) Parade before leaving on Kano expedition; (59) Leaving Zungeru; (60) Behind the officers' lines, Zungeru; (61) Compulsory washing; (62 and 63) Bridge over Dago river; (64) Group of convicts leaving gaol; (65 and 66) Public offices, Zungeru; (67) The hospital and doctor's bungalow, Zungeru; (68) Soldiers' quarters, Zungeru; (69) The market, Zungeru; (71) The Niger Company's stores and railway station, Zungeru; (72) Veranda of bungalow, Zungeru; (73 and 74) Lieut. O'Neill's Zungeru big game heads; (75) Lieut. Peek; (76) Major Cubitt crossing bridge over Dago river; (77–79) Road clearing; (80) Men making camp in bush; (81 and 82) Forcados river; (83 and 93) Sir F. Lugard's yacht *Corona;* (84) A village in the delta; (85) The river-bank; (86) A southern Nigerian station in the delta; (87) A village on the banks of the Niger; (88 and 91) View of the Kaduna river; (89) A steel canoe; (90) A village near Bida, on the Kaduna; (92) A caravan from Sokoto crossing the Kaduna river; (94) Native boys in canoes waiting for bottles to be thrown from steamer; (95) A halt at Katcha; (96) A halt at Egga; (97) Colonel Morland and Mr. Wallace leaving Lokoja; (98) A village in the delta; (99) Canoe on Kaduna river.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

A-KAMERUN BOUNDARY

JACKSON



The

Geographical Journal.

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VALUABLE PRESENTATION TO THE LIBRARY AND MAP DEPARTMENT.

The Society has received a most valuable gift from one of its oldest members, Dr. A. Peckover, of Wisbech, Lord-Lieutenant of Cambridgeshire, who, among his varied interests in the field of scientific and antiquarian knowledge, has long given a foremost place to the study of the history of cartography, having in course of time brought together one of the most important collections of early maps and atlases to be found in this country in private hands. Wishing that these treasures, many of them now almost unattainable by the collector, should benefit as wide a circle as possible, especially among the Fellows of the Society with which he has been so long associated (he joined it in 1853), Dr. Peckover made to the Council the munificent offer to present to its collections of books and maps such of these works as might not already be in the Society's possession. An equally generous offer is not made every day, and, needless to say, it was accepted by the Council under a due sense of the value of the gift. Although the Society's collections of early geographical documents have been much improved from time to time—notably, of late years, by the liberality of another donor, Mr. Henry Yates Thompson, there were still not a few *lacunæ*, in the case of special rarities, a number of which it has now been possible to fill up. The number of works presented amounts to about forty, and an important step has thus been made towards the ultimate completion of a thoroughly representative collection of the monuments of geographical history, which, as the leading representative of the subject in this country, the Society may fitly aspire to possess.

The new acquisitions are all of distinct value, but a few may be singled out as especially worthy of mention. First of all comes a copy of the Italian collection of maps generally known as 'Lafreri's Atlas,' from the fact that many of the maps, and probably also the title-page, were engraved at Rome by Antonio Lafreri. The importance of this early atlas for the history of sixteenth-century cartography was pointed out by Nordenskiöld in his 'Facsimile Atlas,' for the title-page of which a facsimile of that designed for Lafreri's collection was employed.* The maps, which are the finest specimens of early Italian cartography and engraving that have come down to us, were of varying dates and the work of many different draughtsmen, their collection into one set, with general title-page, being the earliest instance of the publication of an "Atlas" in the modern sense of the term, if we except the numerous editions of Ptolemy accompanied by modern maps which appeared during the course of the same century. The comparatively few copies of the Atlas which are known to exist all differ in their contents, which is not surprising, having regard to the way in which the maps were brought together. A list was given by Nordenskiöld of all the maps and plans (142 in all) to be found in his own copy or in the three volumes contained in the library of the "Collegio Romano." The greater number of these occur also in Dr. Peckover's copy, in which the number of plates is 101; a few of the maps, however, and a greater number of the plans and representations of battles and sieges, being not found in Nordenskiöld's list.

Among the more interesting or important of the maps in the Society's new acquisition are: Florianus' map of the north and south hemispheres in radially arranged gores; the map of the British isles (dated 1562 in the present copy, but sometimes found with an earlier date), giving the first tolerably accurate delineation in print of the contours of the coasts, especially those of Scotland; the copy of Olaus Magnus' famous map of the northern regions; the three sectional maps of Asia, by Gastaldi, some account of which was given by Nordenskiöld in the *Journal* for April, 1899 (vol. 13, p. 396); besides many maps of European countries, generally much in advance of any previously published; the earliest in date being Gastaldi's map of Sicily of 1545.

Next, or possibly before this in importance, is a fine copy of Berlinghieri's metrical version of Ptolemy's geography, which is noteworthy as containing not only one of the very earliest sets of engraved maps ever issued, but actually the first printed modern maps. In this respect it possesses an even higher interest than the famous Rome edition of 1478, which included only the twenty-seven Ptolemaic maps. The date is not known with certainty, but from its dedication to Frederick, Duke of Urbino, who died in 1482, it is certainly not later

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* This title-page gives the earliest representation of Atlas bearing the globe as symbolical of a comprehensive guide to geography.

than this year, while some have even held that it is earlier than the Rome edition. The modern maps are those of Spain, France, Italy, and the Holy Land, and already show considerable progress towards a correct delineation of the outlines of these countries. Of later editions of Ptolemy, Dr. Peckover has presented copies of the Strassburg edition of 1520 (the second issue with Waldseemüller's maps); the Venice edition of 1561 (the first Italian translation, by Ruscelli, from the original Greek, with maps based on Gastaldi's); the Cologne edition of 1606 (third of Magini in Latin); and the fine Elzevir edition of 1618, by Bertius, with Mercator's maps, the Peutinger table, etc. With these additions the Society's collection of Ptolemies now includes one or more copies of every important type, with the sole exception of the rare Bologna edition dated 1462 (probably a mistake for 1472 or 1482).

Other works included in Dr. Peckover's gift are the 'Isolario' of Bartolommeo Zamberto, of about 1479—a scarce collection of sonnets, illustrated by woodcut outline-maps of many of the islands of the Ægean, etc.; the 1547 edition of Bordone's 'Isolario;' the first edition (1576) of Porcacchi's 'Isole piu famose del Mondo;' the first (Latin) edition of Wytfliet's 'Descriptionis Ptolemaicæ Augmentum' (1597), giving a series of maps of the newly discovered regions; Quadus' 'Fasciculus Geographicus' (1608), a small atlas of maps, with letterpress, after the Ortelius-Mercator type; Morisot's 'Orbis maritimus' (1643); as well as a number of modern works bearing on the history of geography, which have hitherto been missing from the Society's collection.

LIBERIA.*

By Sir HARRY JOHNSTON, G.C.M.G., K.C.B.

Liberia is a portion of the West African coast-lands which may be styled the end of Northern Guinea. Its southernmost promontory—Cape Palmas—of all the Guinea Coast, projects furthest southwards, to scarcely more than 4° from the equator. The northern political boundary of Liberia meets the coast at the mouth of the river Mano in N. lat. 7°. The actual boundary on the south, between Liberia and the French possessions on the Ivory Coast, is the course of the river Kavalli, the mouth of which river lies about 13 miles to the east of Cape Palmas, in lat. 4° 22'. The northernmost extremity of Liberian territory on the coast lies just to the south of that marshy and densely forested portion of the Sierra Leone colony—the Sherbro district—which one might say, with a fairly accurate guess, was the furthest point reached by the Carthaginian explorer Hanno in his celebrated

* Read at the Royal Geographical Society, March 27, 1905. Map, p. 248.

voyage of discovery along the north-west coast of Africa in about 520 B.C. It is probable that the "gorillas" which Hanno's expedition captured somewhere in the vicinity of the Sherbro river or of northern Liberia were the chimpanzees still found in these regions.

It will be seen on the map that Liberia occupies a most important strategic position on the West Coast of Africa. The general trend of its coast is from north-west to south-east, parallel to the course taken by steamers plying across the Atlantic between Europe and South Africa. It might, in fact, in the hands of a strong naval power, exercise a very dominating influence over the eastern Atlantic, which is one reason, amongst many others, why Great Britain desires to see the independence of the Liberian republic preserved and maintained.

The country of Liberia, as a whole, is one dense forest. It is practically the culmination of the West African forest, the regions to the north, east, and west having been more extensively cleared by man in past times, or partaking more of the park-land, grass-grown character owing to their less copious rainfall. Now that two English companies, in conjunction with the Government of Liberia, are endeavouring to develop the resources of the interior, and to accumulate knowledge regarding the climate and products, attempts are being made to record the rainfall, as to the extent of which at present only a guess can be made. It is probable that south of lat. 8° 30′ the average annual rainfall of Liberia is not less than 100 inches. Adjoining regions in Sierra Leone have a recorded rainfall of something like 130 inches, so that this is probably an under rather than an over estimate. North of lat. 8° 30′ the rainfall diminishes probably to 60 or 80 inches per annum, and in consequence the dense forest gives way to a pastoral country of savannas, grassy hills, or park-lands of grass, with dense forest along the stream valleys. Mr. Alexander Whyte, well known by his many years' work as an official in charge of botanical departments in the British East African Protectorates, spent a good deal of 1904 in Liberia, and in the report which he drew up for my information he considers that this country—which has a seaboard of approximately 350 miles long (from north-west to south-east), and a total superficies of about 45,000 square miles—has two somewhat different climates, depending, no doubt, a good deal on the latitude. In the southern regions below lat. 6°, the rainiest time of the year appears to be the months of March to June, and August to December. North of this—round Monrovia, for example—the specially rainy months are April to the end of July, September and October.

From my own experience of Liberia, I should say that the heavy rainy season begins in April and lasts till the end of July. Then there is a pause of a month or six weeks with less rain, the heavy rains beginning again in September and lasting till the middle of November. From mid-November till the end of March is the dry season, at any rate in the northern half of Liberia. But in the southern part this dry season is not much more marked than it is in the Niger Delta. Rain, in fact, may fall in any month of the year. Between November and April is the worst season for storms, some of which are very violent.

When I first visited the coast of Liberia, in 1882 and 1885, the primeval forest grew down to the sea along a great proportion of the coast; but when I revisited this country in the summer of 1904, and touched at a good many places at the coast where I had noted forest

A MANDINGO.

growing as late as 1888, much of this big-tree woodland had been swept away to make room for plantations or even for towns. In fact, with a few exceptions, the big-tree and rubber-producing forest does not usually begin in its most marked characteristics until a journey of at least 15 miles has been made inland from the coast. I have estimated, from the reports of the agents of the British companies, and from the accounts of Liberian, British, and French explorers, that out of the 45,000 square miles which may be approximately assigned as the area of the

Liberian Republic, at least 25,000 square miles consist of dense, uncleared forest, penetrated, it may be, by narrow native paths, but as often as not only pierced by elephant-made tracks. About 3500 square miles represent the plantations, gardens, towns, and settlements of the Americo-Liberians along the coast, and 2000 or 3000 square miles the clearings made by the indigenous natives in the dense forest. The remainder of the territory—about 15,000 square miles—is grass or park-land in the possession of the Mandingo tribes, who are great cattle-breeders. This is the characteristic of the far interior of Liberia, where it borders on the French possessions of Upper Nigeria. From all accounts I can collect, as well as from the little I have seen myself, I do not think that much of the interior of Liberia can be described as marshy. It is, on the other hand, inclined to be hilly, and at distances of from 40 to 100 miles inland the ranges of hills reach altitudes which might almost be dignified by the name of mountains. Some of these mountains (the Nimba range) attain heights of over 6000 feet—this, at any rate, is the height ascribed to them by certain French explorers; and from what I am told by Mr. Maitland Pye-Smith, one of the agents of the aforesaid British companies, I am inclined to think that 4000 feet, at any rate, is reached or exceeded by peaks in the Satro range. If the reports of certain travellers are justified, however, it may well turn out that there are altitudes (such as Mount Druple) on the Franco-Liberian border of over 9000 feet, and consequently higher than anything that is to be met in West Africa south of the upper Niger and west of the Cameroons. Some of these mountain-sides are precipitous, with faces of bare rock. Others, again, are clothed with dense vegetation to their summits, and this continuance of dense and lofty forests for miles and miles and miles will be a terrible hindrance to surveying in the future, whilst at the present time it gives to Liberian exploration the same sad and somewhat dreary character that has been so powerfully described by Stanley in recording his adventures in the great Congo forest. Much as the botanist may glory in the splendid vegetation, I really think that in the long run one wearies more quickly and easily of forest than of desert.

Forest, in fact, is the distinguishing feature of Liberia as a country; it is the climax of the forest region of West Africa. In and from the forest will be derived the great future wealth of this country. The geologic formation would appear to be mainly Archæan, and the rocks are mostly granite and quartz, with here and there indications of volcanic tuff. The rocks near the sea-coast and in the coast ranges of hills are much impregnated with iron, and are consequently very red in colour. The appearance of this rock, especially where it is revealed by the roads which the Americo-Liberians have cleared in the coast region, is curiously pitted and honeycombed. It is hard, becoming especially indurated on exposure, and this makes it a good surface for road-making, as it does not degenerate into mud. Very little is known about the possible mineral wealth of Liberia up to the present time, as the extremely dense forest of the interior is a great obstacle to a rapid survey of the country. Apart from hæmatite iron, which appears to exist nearly everywhere, there are traces of gold in the mud of the rivers, and native stories assert the existence of alluvial gold in the Mandingo uplands beyond the forest region. Lead has been discovered recently in the Kelipo country in eastern Liberia, and zinc ore in the

BORASSUS PALM AND OIL PALMS.

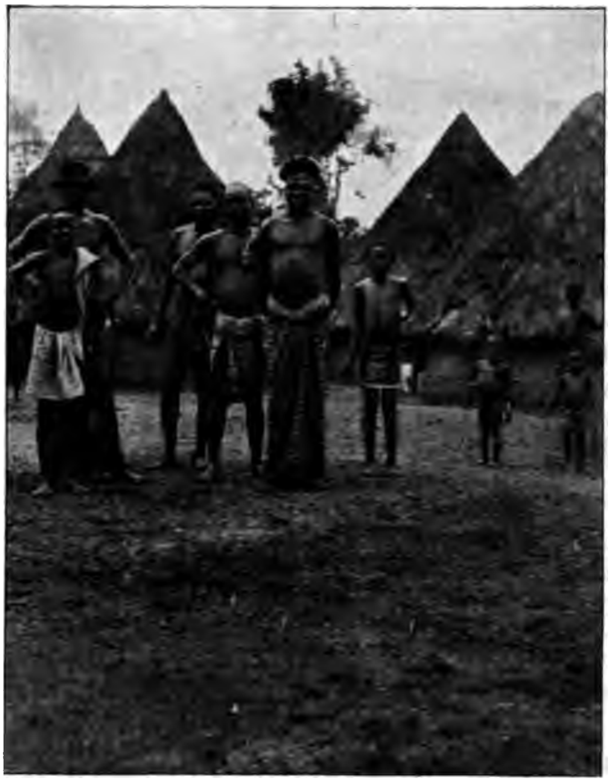
vicinity of Monrovia. In the Kavalli region there is a great deal of corundum in the rocks. It has been alleged that a diamond was discovered in the hills behind Grand Basá by a Liberian, but as yet no confirmation of this discovery has reached me; nor have I been able to ascertain where the copper comes from which is used to a limited extent in some of the Mandingo weapons from the far interior.

The Liberian forests contain most of the West African timber trees. Such ebony as is exported, however, does not seem to be so good as that which is derived from the genus *Diospyros*. It is very probably derived from a papilionaceous tree belonging to the botanical genus of *Dalbergia*.* The wealth of this forest in indiarubber-producing trees, vines, and bushes is without parallel in any other part of Africa, unless it be one or two small areas of the Congo basin. Counting the four rubber-producing figs, there appear to be at least twenty-two trees, plants, or vines which produce saleable rubber. These species include the well-known and widespread *Landolphia owariensis* and the magnificent *Funtumia elastica*, the rubber tree once so abundant in Lagos colony. The *Funtumia elastica* is stated to grow to over 200 feet in height. It closely resembles in appearance the allied species *Funtumia africana*, but there is a very considerable difference in the price of the rubber yielded by the one and the other—the rubber derived from *Funtumia africana* may, perhaps, be sold for eighteenpence a pound, but the well-prepared rubber of *Funtumia elastica* ranges in value from three to four shillings. The distinctive features of the leaves, flowers, and fruit, which enable the observer to decide whether he is tapping the valuable or the valueless *Funtumia*, will shortly be illustrated in my book on Liberia. The range of the *Funtumia elastica* appears to extend from the middle of Liberia eastwards as far as western Uganda. It is found in a portion of the Bahr-al-Ghazal region and in the northern part of the Congo Free State. The *Funtumia africana* is more strictly West African in its range, from Portuguese Guinea to the Congo basin. In the western regions of the Congo Free State and in Angola a third *Funtumia* is found, which, like *Funtumia africana*, is of not much value to the rubber trade. Mr. Alexander Whyte, in his systematic examination of the Liberian flora, which he undertook at my request during 1904, has discovered two new species of wild coffee—*Coffea nudiflora* and *Coffea ligustrifolia*. The well-known Liberian coffee with a big berry is, of course, indigenous to the country, and is now being exclusively cultivated by the Americo-Liberians on the coast.

In Liberia, of course, as in most densely forested countries, the displays in colour masses of large aggregations of flowers are not so often observed as in the park-lands and more open country. Still, there are many objects of beauty in the forest which should be enumerated as prominent features in Liberian scenery. Every pool and creek of still water is covered with water-lilies, chiefly the common *Nymphæa lotus*, a small variety of which is also present, and is peculiar to Liberia. In the damp glades there are abundance of *Crinum* and *Hæmanthus* lilies. A small and very beautiful terrestrial orchis grows on the surface of the water in shallow pools. In the dense forest there are numerous epiphytic orchids, chiefly *Angræcums*, with enormously long

* There are two species of ebony-producing Dalbergia in Liberia, one of which has just been discovered by an agent of the Monrovian Rubber Company—*Dalbergia liberica*.

nectaries. A species of vanilla grows wild in the bush. There are many zingiberaceous plants in the undergrowth of the forest, sometimes with large and delicately coloured flowers, at others remarkable for the size and rich colouring of their leaves. Amongst these may be noted *Costus*, *Amomum*, *Thalia*, and *Renealmia*. Another family of plants well-represented in the undergrowth, and remarkable for the variety and beauty of their foliage, are the arums. Prominent amongst these are



A VILLAGE IN THE SUPO COUNTRY.

Anchomanes, *Culcasia*, *Nephthytis*, *Aglaonema*, and *Cytosperma*. The *Lonchocarpus* tree has at times magnificent displays of lilac blossom, not unlike wistaria in shape and colour. The waxy-white camelia-like flowers of the *Anona* are objects of great beauty, especially where they are thickly clustered along the horizontal branches. The *Mussændas* also light up the forest with their red or white bracts. One *Mussænda*, or a closely allied plant, has gorgeous scarlet-crimson bracts like a *Poinsettia*; another, which is very common, not only in Liberia, but throughout the whole forest region of West Africa from Portuguese

Guinea to Uganda, has a cluster of large white bracts below the yellow flowers. These bracts, which are leaf-like in shape (though not like the leaves of the plant itself), look at a distance like foliage cut out of white velvet. The *Ochna multiflora* is a beautiful flowering tree.

Beyond the forest region a park-like country is entered, inhabited for the most part nowadays by a more or less Muhammadanized people, belonging chiefly to the Mandingo stock. These Mandingos keep large herds of cattle, examples of which find their way down to the coast through the forest roads. They are similar to the breed which is on sale at the market of Sierra Leone—smallish, straight-backed cattle (without a hump), one-coloured as a rule (fawn or grey or reddish-yellow), with rather long horns. This breed resembles in miniature the long-horned Gala ox which is found in southern Abyssinia, and thence, with several breaks in its distribution, to Uganda and the west side of Tanganyika, and across the Nile to the shores of Lake Chad. The Mandingo ox is, to my thinking, simply a dwarfed variety of this Gala breed, which seems to have been the oldest form of domestic ox known in Africa. In origin it is thought to be more connected with the Indian cattle than with the descendants of *Bos taurus*; but when it is found in its purest form, it has not got the hump that is associated with the zebu species, though it freely mixes with that type, and sometimes thus acquires the zebu hump in addition to the characteristics of the extremely long spreading horns (longest in the cow) and the tendency to be one-coloured. I am not so sure myself that this type of ox is necessarily descended from *Bos indicus*. It is represented in the paintings of the Egyptian monuments together with the zebu type. It may have been descended from an intermediate type of wild ox native to North-East Africa—intermediate between *Bos taurus* and *Bos indicus*.

In this open Mandingo country of hills, mountains, and grass-lands there is said to be a great deal of big game. The lion exists there, hartebeests of the West African type, water-buck, giraffe, roan antelope, reed-buck, possibly zebra, rhinoceros, and giraffe. Elephants are abundant all over Liberia down to within about 30 miles of the coast region. In fact, many of the paths through the forest are little else than elephant tracks. Elephants are a good deal dreaded by the natives of the forest region, as they are alleged to attack man quite unprovoked. They do a great deal of damage to plantations. The Mandingos, by-the-by, have horses similar in appearance to the native breeds of Nigeria. Occasionally one of these horses finds its way down to the coast in Liberia; but, as a rule, the few horses one meets with at Liberian coast towns have been brought by sea from French Guinea (Konakri). It is an important fact, however, of great negative value, that apparently there is no Nagana or tsetse fly disease in Liberia. No doubt there are one or more species of *Glossina* related to the tsetse fly, but they do not carry the celebrated tsetse disease to horses and cattle.

The principal and remarkable animals of the Liberian forest region are, amongst antelopes, the handsomest of the Tragelaphs, the bongo. This splendid animal, good specimens of which are to be seen in the Natural History Museum at South Kensington, is almost the largest in size of the Tragelaphs, being exceeded only by the eland. It is magnificently coloured bright chestnut-red, with a few points of black, and bold

A CANNIBAL FROM THE INTERIOR.

white stripes and bars. It seems to be fairly common in the Liberian forests, which also conceal in their recesses curious developments of the Cephalophine antelopes, or duykers. These duykers, in other parts of Africa, are usually associated with the idea of a very small antelope. But in Liberia there is the wide-spread *Cephalophus sylvicultrix*, which is nearly the size of a small cow, and *Cephalophus jentincki*, which is about the size of a fallow deer, with short stout horns. Besides several small types of duyker, there is the tiniest of all the antelopes—the royal antelope—not so large as a hare; and there is the beautiful zebra antelope, which is bright yellow-bay boldly marked with bold black stripes, a most unusual coloration in this group. The buffalo of the forest region is the red-haired, dwarf short-horned buffalo. The ordinary big hippopotamus is said to be present in the lower Kavalli river; but Liberian streams and forests are for the most part frequented by the pygmy hippopotamus, an animal which probably extends its range from the interior of Sierra Leone to the French Ivory Coast. Before I leave the question of the fauna, I should like to mention that, in addition to there being apparently no Glossina fly to spread the tsetse disease, there is a great relief in other directions from the ordinary insect pests of Africa. Mosquitoes are very seldom met with. In fact, they seem to be entirely absent from much of the forest region. Nor are white ants very common or destructive in the centres of population.

The human population of Liberia consists of the following elements, which may be divided, first of all, into indigenes and Americo-Liberians. The former number something like two millions, and the latter between twelve and fifteen thousand. So far as the outside world is concerned, the world of treaties and congresses, the country which we know as Liberia is considered to belong to and be governed by this small caste of English-speaking negroes and half-breeds of American origin. These English-speaking negroes certainly govern and administer the coast-line and a belt of more or less settled country which extends from 20 to 40 miles inland. Of late years they have been on generally friendly terms with the two million indigenous negroes, some of whom have come very much under their influence.

The Americo-Liberians are the survivors or the descendants of freed slaves or persons dissatisfied with their social condition in the United States of America during the early part of the nineteenth century. A considerable number of them also came from the British West Indies; but the movement which founded Liberia—the black republic on the West Coast of Africa—originated with certain philanthropic societies in the United States about 1821. The idea, however, in its genesis was the outcome of that still earlier movement in Great Britain which led to the formation of Sierra Leone. When British philanthropy in the eighteenth century was awakened to the injustice of the slave trade and the unhappy condition of many of the runaway slaves or freed negroes in the West Indies or in British America, it was decided to repatriate a number of these people, and for that purpose (possibly also with an eye to the main chance in securing for Great Britain one of the few good natural harbours on the West Coast of Africa—Sierra Leone) a settlement was formed on the site of the modern Free Town, without overmuch regard to the feelings or rights of the local inhabitants. In the same way, when it was decided in the United States to found a home for the repatriated African, the prior experiment of Sierra Leone turned attention towards the same coast, and in 1821 and at subsequent dates settlements were effected, firstly at Monrovia, and later on at Roberts Port, Grand Basá, Sinó, and Harper (Cape Palmas). Usually those who conducted the enterprise went through the form of buying small plots of land from local headmen or chiefs; but, as a rule, the promoters of this movement did not trouble overmuch about the rights of the "bush niggers," as the indigenous natives were termed. Consequently, the first fifty years of the history of Liberia were marked by constant struggles between the Americo-Liberian invaders and the native blacks. During the last ten years, however, there has been a marked advance in

THE KAVALLI RIVER.

good relations between the American settlers and their native subjects, as many of them may fairly be called. The wise policy of President Barclay has greatly promoted this good feeling since 1904. He has been able to assemble at different times at the capital chiefs or their representatives from almost all parts of Liberia, even from the Mandingo districts just beyond the limits of the coast-belt. Therefore they have no subject of disagreement. Curiously enough, one example of this mild rule of black by black is that the white man in Liberia is everywhere received with great friendliness, because he is not associated in the minds of the natives with anything like conquest or oppression.

How far the original experiment will succeed, the next twenty years will perhaps indicate. The negroes of American origin who have settled in Liberia have not, as a general rule, been able to stand the climate very much better than Europeans, and as a rule they have not been able to rear large families of children. Yet it seems to me as though Liberians of the new generation born in the country are beginning to take hold; but this is partly due to the increasing—and I think very sensible—practice of intermarriage with women of the fine vigorous indigenous races. Probably the future of Liberia will be a negro state very like Sierra Leone in its development, with English as its Government language, and such English or American institutions as may prove to be suited to an African country, a coast-belt inhabited by negroes professing Christianity and wearing clothes of European cut, and a hinterland of Muhammadans dressed in the picturesque and wholly suitable costume worn at the present day by the Mandingos and by most Muhammadan negroes between Senegal and the White Nile.

The native races of Liberia, the languages they speak, and the religions they profess may, to a certain extent, be grouped under two classes, the Mandingo on the one hand, and the Kru negro on the other. I am aware, of course, that the Mandingo type is a very variable one physically, according to the less or greater degree of Caucasian blood which permeates its negro stock, and also that the Kru man proper is confined in his distribution to a small portion of the southern coast of Liberia. But each of these types is sufficiently representative to serve as a general illustration of the two classes of Liberian peoples. Associated with the Mandingos to a great extent, in language, in Muhammadan religion, and in the adoption of the Arab dress, are the Vai and the Gora of western Liberia, and to some extent the Buzi, or Kimbuza. All the remaining tribes are more or less related to the Kru stock in language, appearance, physique, customs, and the profession of a pagan and fetishistic religion, similar in general features to the fetish religions of all Western and West Central Africa, with some points of resemblance to the Bantu beliefs in the southern half of Africa. The Gora language of western Liberia is rather a puzzle in classification, and it must be admitted that it only offers the slightest affinity to the Mandingo group, and an equally slender connection with the Kru family. In a still more generalized way, it may be said that there are distant resemblances between the languages of the Kru and Mandingo stocks; nor can these slight resemblances be altogether explained by the mere imposition of linguistic influences. The Mandingos, who are destined to play a most important part in the development of Liberia and of much of West Africa, are nothing but a varying degree of cross between the Fula race of the West African park-lands and the ordinary West African negro. This crossing, and the founding of this group of people —the correct pronunciation of whose name seems to be Mading'a, or Manding'a—may have been a relatively ancient one. The Mandingos, in fact, are the Swahilis of West Africa, and offer a striking resemblance in face to the average type of Swahili porter that one meets with on the Zanzibar coast. They also often resemble natives of Uganda, and for the same reason—that a good deal of the population of Uganda is infused with a slight Hamitic element derived from the Hima aristocracy. Several Mandingos whom I met at Monrovia were able to speak Arabic in a halting fashion. The Arab words they understood best were those pronounced in the North African dialect. It seemed to me that in some cases the Caucasian element in the Mandingos was derived from direct intermixture of Berbers and Arabs from North Africa with the negroes of the upper Niger. I doubt if any pure-blooded Fula people extend their range into the northern limits of Liberia; but they have had an undoubted influence in times past over the development of the park land which lies beyond the forest. By their minglings with the indigenous negroes of the Sudanese and West African type, they have created the Mandingo peoples, and have also carried Muhammadan civilization and tenets into that part of Africa, as well as, no doubt, the Sudanese breeds of cattle and sheep. The domestic sheep of all the *forest* region of Liberia is that common to the other forested parts of West Africa—the sheep with erect ears, fairly well-developed horns, small size, black and white colouring, a tail without any fatty development, and a long throat mane in the male. Far back in the interior of Liberia, I am informed that the Mandingo sheep are similar to those of the Sudan, with fat tails and without the throat mane.

It should hardly come within the limits of the present paper to discuss one of the most interesting problems in Africa—the origin of the Fula race. Personally, I am still disposed towards the old theory that the Fulas were an early cross between the Libyans of North Africa and the negroes of Senegal, a cross in which the Caucasian element predominated considerably. They certainly offer marked resemblances, however, to the Hamitic aristocracy of the upper Nile and the lake regions. Their language is a complete puzzle. At present it cannot be said to offer affinities of a marked kind to any group of negro speech; but it is emphatically a negro tongue (with a faint suggestion here and there of the Bantu family), and not in any way influenced by Hamitic, Libyan, or Semitic characteristics. As to the Libyan affinities of Hausa there can be no doubt, but nothing of the kind has as yet been discerned in the structure or vocabulary of the Fulfulde. It even seems to offer less resemblances in structure to the Hamitic language-family (for example) than can be discerned in the Bantu.

Of all the peoples in Liberia affiliated with the Kru stock, perhaps the most numerous group is that of the Kru, which occupies the coast of Liberia between the French frontier at the Kavalli river and the river Sestos. With the Kru I associate the Grebo, as the two peoples differ but little in language, and scarcely at all in physical type. The

Grebos are inclining strongly towards Christianity, but very few, if any, converts to that religion have been made amongst the Kru people proper who inhabit the coast between Greenville and Garraway. Krus and Grebos together number something like 375,000. The next most important group of people, as regards numbers, are the Mandingos, of whom there are, perhaps, 300,000 within the limits of Liberia. After them may be ranked the Kpwesi people, a general term for a congeries of tribes speaking dialects of a common language. These Kpwesi (familiarly known by the Americo-Liberians as Pessi, or Pessa) may be as many as 250,000. In an appendix to this paper the rest of the tribes and their approximate numbers are enumerated.

In the central parts of Liberia, within the limits of the forest, there is no doubt that cannibalism prevails. This is a very marked feature in the life of the Beila, or Bele. These people are said to relish most keenly the hands and feet, and this very dainty dish is usually set before a king or chief alone. Nowhere in Liberia have I noticed—nor has any explorer encountered or reported—any race of negroes wholly naked, either among men or women, such as are so commonly met with in Eastern Equatorial Africa, or until a few years ago in parts of South Central Africa. A certain degree of complete nudity in unmarried women was at one time quite a common feature of the natives of the Niger delta, the Cross river, and the Cameroons, while on the upper Cross river complete nudity among the men was just beginning to disappear twenty years ago. Throughout Liberia no one has ever observed complete nudity amongst either men or women. Though there are a few rare exceptions to this rule, it may generally be observed that the marked feature of male nudity so characteristic of the upper Nile, the Eastern Equatorial regions, and originally of the north end of Lake Nyasa and Central Zambezia, is never met with in the forested regions of Africa, except possibly here and there amongst the Pygmies. Throughout the Congo basin and countries as completely savage as the innermost parts of Liberia, the men wear a minimum of clothing, which is a concession to ideas of decency, and which, when the race is quite out of touch with the trade of the outer world, is generally a strip of bast (bark cloth) from a fig-tree. I have not observed any of the savages from the interior of Liberia wearing dressed skins. I am told that so greedy are they after food, that when any beast is killed the hide is roasted and eaten. On the other hand, the civilized Mandingos of the north have learnt from the Fulas or from the Moors, or possibly from both, the most beautiful work in leather.

Nowhere along the coast of Liberia is there a harbour in the sense of the bay at Sierra Leone. All the anchorages, in fact, are open roadsteads. But, on the other hand, this is not a particularly dangerous condition for ships, as the south wind never blows strongly enough to raise a big sea, whilst the north wind, coming from off the land, can only affect the Atlantic at some distance from the shore. But, of course, this portless condition adds very much to the discomfort of dealings with Liberia. Although the swell from the choppy surface raised by the wind may not be sufficiently serious to affect big vessels lying at anchor, it is not at all nice for small boats or steam-launches, and generally during the rainy season of the year transference from the big steamer to the shore-going boat has to be effected by means of a crane and a cradle. Still more to be dreaded on some points on the coast is the landing or the going off, on account of the surf. Perhaps the best approach to a sheltered harbour which exists is at the capital, Monrovia.

FOREST COMING DOWN TO SEA-SHORE.

Here there is a bar to a small river or creek which communicates with the St. Paul's river. The bar is very seldom rough, being to a certain extent sheltered by a promontory, and once across the bar you can land quite comfortably on the beach in perfectly smooth water. But at places like Grand Basá, Sinó, and Cape Palmas, the landing can be extremely dangerous and disagreeable. One seldom arrives at or departs from these places without, at any rate, a wetting from the rollers that break over the stern or bow of the boat. However, real accidents to persons or property are, it must be confessed, of rare occurrence, and the whole question depends very much on the good or ill will of the Kru boys who direct the steering.

The Kavalli river, though probably less in volume than the St.

Paul's, is the most navigable as a means of access to the interior. Unfortunately, there is a very bad bar at the mouth of the Kavalli, or it would have played a very different part in the history of West Africa. Once across the bar, a steam-launch or a rowing-boat can ascend the river for about 80 miles, when the first rapids are reached. The upper Kavalli is imperfectly known, and, indeed, its extreme upper course is still a matter of conjecture. On the definition of its course depends to a great extent the laying down of the north-eastern frontier of Liberia according to the French Treaty of 1892.

The St. Paul's river is only navigable as far as a place called White Plains, about 20 miles from the mouth. There is no difficulty about the bar at the mouth of the St. Paul's, for this reason, that one can land with little or no risk at Monrovia; and once inside the Mesurado river (which is merely a creek), one can embark on a small river steamer, of which there are two or three in existence, enter the St. Paul's river by the Stockton creek, and thence ascend the St. Paul's to the first rapids near the settlement known as White Plains. All the lower part of the St. Paul's river is pretty thick with Americo-Liberian settlements, some of them of a distinctly prosperous and prepossessing appearance. Several of the officials at Monrovia have country houses on the banks of the St. Paul's amid charming surroundings. This great virtue may be attributed to the Americo-Liberians, that they certainly know how to build houses, comely in appearance, sanitary, and lasting, or as reasonably durable as one can expect in a land of heat and moisture. In fact, the leading characteristics of the Americo-Liberians are their love of building and their remarkable politeness.

For some distance above its first rapids the St. Paul's river is scarcely navigable for canoes; but in the little-known region north of Dobli Zulu island, it is said to be navigable for canoes up to its junction with the Tuma, which is also stated to be an important stream.

Eastwards of Monrovia, the Mesurado river or creek reaches, as a navigable piece of water, to within a very short distance of the Junk creek, which is a branch of the Dukwia river; so that, except for a little isthmus of sandy soil, Monrovia might be situated at the western extremity of a long island. With developments that might come later on, it would be very easy to cut a canal to join the Mesurado and the Junk rivers. This would then give access for vessels of light draught to the Dukwia and Farmington rivers. These streams debouch at a settlement of some importance named Marshall; but the bar at Marshall (mouth of the river Junk) is extremely bad and dangerous. As a matter of fact, with a very little expenditure of money Monrovia might be made a good port.

The population of Monrovia, so far as Americo-Liberians and foreigners are concerned, is about 2500. It has a system of telephones which connects it with the settlements on the St. Paul's river. This has been set up, and is well worked, by a native Liberian. It is, perhaps, hardly necessary to remind you that Monrovia was named after the celebrated President of the United States, Monroe, who is responsible for that doctrine which inhibits any European nation from further conquests in the New World. The capital of Liberia is divided into two parts, the low and shoreward section being given over to large settlements of Kru boys and indigenous negroes, while the upper part of the town is inhabited by Americo-Liberians and European consuls, traders, etc. This civilized part of the town is composed of broad grass-grown streets, and substantial, well-built, comely-looking houses, churches, offices, and public buildings. The smart appearance of the houses, in fact, is in somewhat striking contrast to the neglected condition of the roads. These have never been made, and are simply the unlevelled rock of more or less flat surface. Consequently, at the present time they are absolutely unsuited to any vehicle, though I have seen an enterprising Liberian negotiate them with a bicycle. They are generally covered with a very short, close turf of thickly growing plants, which is kept in the condition of turf by the constant nibbling of the pretty little cattle that frequent the streets of Monrovia. A less agreeable feature are the pigs, which exist in great numbers and perform the office of scavengers. The appearance of most of the houses is, as I have said, either very striking or comely both in form and colour, and this appearance is enhanced by the beautiful clumps of trees and the gardens which surround most of the houses. The Americo-Liberians seem to be very fond of flowers, and have gardens full of roses, oleanders, allemandas, bougainvillia, and frangipani in constant bloom. There are numerous churches and a masonic hall.

There is a good deal of civilization and comfort and signs of progress at the settlements, which are grouped together under the general name of Grand Basá, and also at the Sinó towns, the principal of which is named Greenville. But perhaps, on the whole, the most go-ahead and energetic assemblage of Americo-Liberians is to be found at Harper (Cape Palmas). Here there is a philosophical society, which is doing a good work in collecting and printing statistics about Liberia. But Harper, unfortunately for Europeans, is a good deal more unhealthy than Monrovia.

Compared with other parts of West Africa, I should say that Liberia is less unhealthy for the European than Sierra Leone, the Ivory Coast, the Gold Coast, or Lagos. But it is, perhaps, too soon to judge. It is noteworthy, however, that the remarkable absence of mosquitoes should to a great extent coincide with a less marked prevalence of malarial fevers.

From the European point of view, perhaps the most healthy part of Liberia is the northern half, and from all accounts it would be the

Mandingo plateau that Europeans would prefer for their trading or mining settlements.

The great undoubted wealth of Liberia lies, as I have already pointed out, in its rubber, but the trade in this product is as yet only in its infancy. Another important article of export in the future will be timber. Piasava, which is a fibre derived from the rind of the fronds of a Raphia palm, figures to some extent in the exports, which also include coffee, a little cacao, ivory, copal, palm oil, palm kernels, ginger, cam-wood, and anatto.

APPENDIX I.

Peoples and Tribes of Liberia.

The following is a summary of the principal Americo-Liberia towns and settlements with their approximate populations. The enumeration commences with Roberts Port, not far from the western (Sierra Leone) frontier of Liberia, and proceeds northwards, southwards, and eastwards to the French frontier along the Kavalli river:—

		Americo-Liberian population.
County of Montserrado:—		
Roberts Port		400
Royesville		50
St. Paul's river settlements—		
New Georgia	200	
Caldwell	200	
Brewerville	300	
Clay Ashland	400	
Louisiana	100	
New York	50	
White Plains	300	
Millsburg	250	
Arthington	300	
Careysburg	400	
Crozierville	100	
Bensonville	150	
Robertsville	150	
Harrisburg	250	
	—	3150
Settlements on the Mesurado river:—		
Barnersville, Gardenersville, Johnsonville, Paynesville ...		200
Monrovia		2500
Junk river settlements—		
Schiefflin and Powellsville	225	
Mount Olive	150	
Marshall	125	
Farmington river and Owen's Grove ...	300	
	—	800
County of Grand Basá:—		
Basá settlements—		
Little Basá	50	
Edina	250	
	—	300
Carried forward		7400

		Americo-Liberian population.
Brought forward		7400
County of Grand Basá (*contd.*):—		
Hartford	50	
St. John's river ...	350	
Upper Buchanan ...	400	
Lower Buchanan (Basá)	600	
Tobakoni	50	
	—	1450
Coast between Grand Basá and river Ses ...		150
On the river Ses ...		50
County of Sinó:—		
Sinó Settlements—		
Sinó river	50	
Lexington	100	
Greenville	350	
Philadelphia	125	
Georgia	125	
	—	750
Settlements on Kru Coast—		
Nana Kru, Sete Kru, Nifu, Sas Town, Garawé		150
County of Maryland:—		
Settlements round Cape Palmas and on the lower Kavalli river—		
Rock Town	100	
Harper	500	
Philadelphia	100	
Latrobe	50	
Cuttington	100	
Half Kavalli	50	
Hoffman	50	
Middlesex	50	
Jacksonville	75	
	—	1075
Carried forward		11,025

		Americo-Liberian population.
Brought forward		
County of Maryland (*contd.*):—		11,025
Bunker Hill	25	
Tubman Town	100	
New Georgia	25	
Hillierville	25	
		175
Carried forward		11,200

	Americo-Liberian population.
Brought forward	11,200
Americo-Liberians scattered about Kelipo in far interior of Maryland County; in the Boporo country, near the Sierra Leone frontier, and on the upper St. Paul's river, etc., say	150
Total Liberians of American origin	11,350

There are a good many other native villages and small isolated settlements or farms of Americo-Liberians, which it would be tedious to enumerate by name. The ones and twos in such scattered settlements as these (such as Fish town, Puduke, Weabo, Pequenino Ses, etc.) may be taken as a set-off against any possible exaggeration of numbers in connection with the more populous places.

These Americo-Liberians at present constitute the governing caste of the country. In origin, about two-thirds are from the United States of America and one-third from the British West Indies. It is curious that in a general way the men who have come most to the front in the history of Liberia have been of British West Indian descent rather than emigrants or descendants of emigrants from the United States. They came, or their ancestors came, to Liberia rather to seek a profitable field for their enterprise than in any attempt to flee from conditions of slavery, or other kinds of unsatisfactory social environment. The Liberians of British West Indian origin have generally been removed one, or even two, generations from a condition of slavery. They are also for the most part better educated, and remember more as to their actual African origin than is the case with those whose immediate ancestors have come from the United States. For instance, the present President of Liberia, the Honourable Arthur Barclay, knows that the negro stock from which he sprang came from the district of Popo, now on the borderland of French and German territory, in the western part of the Dahome coast. English is naturally the universal language used by the Americo-Liberians. It is variously spoken by them, those originally of United States origin speaking it with a very strong "American" accent, while the Liberians who have sprung from the British West Indies talk English—that is to say, educated persons do—with but slight accent, and in the case of those who have received additional education in England, with no very obvious accent at all. A good deal of connection in sentiment is still kept up with the United States, though perhaps there is an increasing tendency, so far as higher education is concerned, for the despatch of young Liberians to study in England at such places as the Liverpool schools and the African Training Institute of Colwyn bay. But several local educational institutes are generously maintained by American philanthropists. The station of Arthington, on the St. Paul's river, is named after the celebrated philanthropist of that name connected with Leeds (Yorkshire), who did so much to establish the first missionary steamers on the Congo, and whose name is very gratefully remembered in Liberia for the assistance that he has given in educational work.

The indigenous population of Liberia, not of extraneous origin, may be estimated with some correctness at a total of about 2,160,000. They may be enumerated as follows:—

Locality.	Name of tribe.	Approximate numbers.
County of Mesurado	Vai	100,000
	Dé	10,000
North of the Vai	Bandi	200,000
North of the Bandi	Kisi	150,000
Beyond the Kisi people	Buzi	50,000
Beyond the Buzi, stretching over to the north-western and northern parts of the Republic ...	Mandingo ...	300,000 *
Behind the Dé people, along the St. Paul's river at the back of Monrovia	Gora	150,000
North and east of the Gora people	Kpwesi † ...	250,000
Beyond the Kpwesi, to the west and north, are the Buzi (already mentioned) and the tribe known as	Bere, or Belo ...	50,000
To the north of the Bere	Gizima and Buni	30,000
On the coast, beyond the Dé people of Monrovia, begins the big tribe of Basá people, and further inland the	Basá Gibi ‡ ...	200,000
South of the Basá group, along the coast from the northern limits of Sino county to the Kavalli river, are the	Kru tribes § ...	875,000
Behind the Kru coast are the	Putu people ‖ ...	150,000
Behind the Grebo, in the Kavalli region (Maryland county)	Kelipo	150,000
Approximate total of indigenous negro population of Liberia		2,165,000

* It is probable that the total population of the various Mandingo tribes considerably exceeds this estimate, which is arrived at by putting together the computations of each separate branch, as given to me by its representatives at Monrovia. The proper pronunciation of the well-known tribal name Mandingo appears to be "Manding'a," or "Mading'a." They are a race that will play a very notable part in the development of West Africa. The whole of this tribe, which populates the hinterland of Liberia, parts of Sierra Leone, and the southern part of the French "Sudan," must number one or two millions. Their language is harmonious in sound and simple and logical in construction, therefore easily acquired. They are Mohammedans to a very great extent, only a few branches in the Liberian hinterland remaining pagan. In consequence, they dress picturesquely and suitably like the majority of Mohammedanized Africans in the Niger basin and the Northern Sudan, with wide breeches, voluminous tobes, and fezzes or round skull-caps. They are a fine-looking race as regards physical development, and their physiognomy reveals the secret of their power, namely, the slight infusion of Caucasian blood. They are, in fact, the result of an early intermingling of the Berber from the Sahara desert with the negroes of the Niger basin. They are a very industrious people, with a remarkable feeling for art, which is at present confined to elaborate leatherwork and the shaping of picturesque garments. The principal divisions of the Mandingo race in the hinterland of Liberia —proceeding from west to east—are the following: Boporo, Kwang'a, Mwela, and Dukwira. Their towns are nearly always surrounded by clay walls, the architecture of which, judging from such photographs as I have seen, is strongly reminiscent of the towns of Nigeria.

† This is the race named on most maps in the incorrect orthography "Pessy." It knows itself as Gbele, but for some reason is called by most of the surrounding tribes Kpwesi, which, on various grounds, is the most convenient name. A portion of the Kpwesi race is known as the Gbwaliu, a name that appears incorrectly on our maps as "Barline."

‡ Behind the Basá and Gibi peoples one comes again to the great Kpwesi tribe.

§ The Kru tribes may be divided up under the following designations, but all the

The Americo-Liberians, of course, are Christians, belonging entirely to various sections of the Protestant Churches—Anglican, Episcopal Methodist, Methodist, Baptist, Presbyterian, etc. There is one establishment at Monrovia of the White Fathers, a Roman Catholic Mission, mainly French and Dutch in the nationality of its missionaries. So far, the fathers have made no converts, but the mission has only just been established. There is a good deal of activity amongst the various missionary societies dependent on the Protestant Churches represented in Liberia, and this is largely financed from the United States of America. The work is carried on almost invariably by missionaries having some proportion, large or small, of African blood in their veins. A good deal of their work is educational, and has certainly brought solid advantages to the coast negroes of Liberia. Outside the negroes of American origin, there are not many converts to Christianity. Such as there are come from the Kru peoples and the Grebo principally. Perhaps, of all the native races, the Grebo is the most Christianized and civilized. The Vai, some of the Gora, and nearly all the Mandingo peoples are Mohammedan—not fanatically, but very genuinely, as regards adherence to Mohammedan precepts. The spread of Mohammedanism in the western and northern districts of Liberia has been of immense benefit to the country, diminishing the traffic in alcohol and checking drunkenness, which elsewhere in Liberia is so common amongst the negroes—a drunkenness induced just as often by the native forms of alcohol (palm wine, etc.) as by the consumption of European spirits.

At the present time the ports of entry into the Liberian Republic at which foreigners may settle and trade are the following (running from west to east): Roberts Port, Monrovia, Marshall, Grand Basá, Grand Ses (Cess), Greenville, Nana Kru, Cape Palmas, and Kavalli. Foreigners also are allowed to trade within a zone of 3 miles along all the inland frontiers of Liberia. It is, I believe, the intention of the Liberian Executive to add to these recognized ports of entry places in the interior and on the coast as soon as communication has been opened up and the Liberian Government is in a position to maintain law and order at these places.

After the reading of the paper—

Mr. Alexander Whyte: I feel it is almost presumption on my part to say even a few words. We have not only listened to a lecture, and a very interesting one, on Liberia, but we have seen a regular panorama, a panorama of almost every subject you could think of connected with Liberia, and, I believe, absolutely the first that has been displayed before a London audience. There are many very interesting problems connected with the country of Liberia. Sir Harry Johnston touched, for instance, on the absence of mosquitoes from Liberia. A very extraordinary fact indeed; and any one who has travelled in tropical countries, as I have done for the last fifty-two years, and seen the natural habitat or abode and breeding haunts of the mosquitoes, would at once come to the conclusion that

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people included under these names do not extend further into the interior than about 60 miles from the coast:—

Sinó people	75,000
Sikong (beyond the Sinó)	100,000
Kru people proper (including all isolated colonies of Krumen elsewhere in Liberia)	140,000
Grebo people	60,000

‖ The Putu people seem to include the following subdivisions or separate tribes: Tatue, Nyapo, Pete, Tuo, and Gireo.

Liberia was an appropriate place, an ideal home for these pests. It is a curious thing that they are to be found on the coast, though not in large numbers, but for 8 or 10 miles inland, on the very ground where you would expect them to breed most, you find scarcely one, and it is the one redeeming feature in connection with travelling in Liberia that there are no mosquitoes. From a scientific point of view, it is a very interesting subject to go into. The general opinion, I think, is that what accounts in some reasonable way for their absence is that there must be some hostile bacteria in the swamps which affect or destroy the larvæ of the mosquitoes. Granting that such is the case, I have an idea—and I think it is quite feasible—that tons of that soil might be transported from these what you might call anti-mosquito swamps of Liberia and distributed in countries where the mosquitoes abound, to see if it would be successful there in inoculating or destroying the larvæ of the mosquitoes. That, I think, might lead to very satisfactory results. Sir Harry Johnston has given us a very good idea of what the aboriginal inhabitants of the interior were like. I travelled among them during two long journeys from the coast, and, according to my idea, they are a much more interesting people than those living along the coast belt. For weeks and weeks I have travelled through districts where no white man has been seen before, and naturally enough met with considerable difficulty in getting from tribe to tribe. They are very jealous and envious of one another, and their great object, when they get a white man among them, is to keep him there, and the difficulty is to get from village to village. Their great object is to do away with all roads and everything in the shape of a road or a bridge. And the one great thing is to overcome that jealousy and to allow a freedom of passage from village to village. Another interesting feature struck me very much, and that was that, although mosquitoes are not met with, there are clouds of midges, or gnats. Sometimes, especially in the afternoon, these pests are very troublesome, and we passed through several villages where they were to be seen in large numbers. But in one particular village, down the middle of the street, which was a green sward, there was a row of posts about 15 feet high, and on the top of these posts there was a hood made of palm leaves, and these hung down in a sort of conical shape with an opening below, very much like a bee-hive, and I saw thousands and thousands of little tiny birds flying in and out of these little cages, and they were engaged the whole day long devouring the gnats. I knew the bird at once—it was the little tiny martin or swift; and they had almost cleared the village of these pests.

If there is one feature connected with the black races in Africa more extraordinary than another, it is that they have no affection for domestic animals as pets. Their idea of domesticated animals, such as pigeons, fowls, goats, sheep, and all the rest, is very much the idea of what they call generally in the Bantu tongue "yama"—something to eat. But they have no real affection whatever for pets. I thought I had made a great discovery, and I was very proud of it, and I went up and down that village and made inquiries while our tents were being put up. I asked the headman, a very fine fellow, "What do these little birds live there for?" "Oh," he said, "Master Junglie man put up these houses, and dem little birds come and make plenty pickaninnies, which they eat." However, I got hold of the chief, and asked him about it, and he told me plainly and distinctly that they didn't breed these birds for eating, but they were kept there as a charm, and looked upon as birds of good omen, and that no one, not even a child, would be allowed to touch them. So that in this one particular at least the natives had evidently acquired a taste for keeping these swifts in a semi-domesticated state. And their presence added very greatly to the comfort of the inhabitants, because of the destruction of these insects. I do not know that I have anything more to add, except to thank you for giving me an opportunity for saying a few words and to congratulate the lecturer on a very interesting paper.

The PRESIDENT: We have to thank Sir Harry Johnston for a most interesting paper, admirably illustrated, and we have also had the advantage of hearing some music of his friends from Liberia, and also of hearing an eloquent speech on the subject of the indiarubber trade, which we were probably not entirely able to understand. He has described to us the character of the civilization of the Americo-Liberians, and he has described the other tribes inhabiting that region, and the flora and the fauna of the forests, giving us altogether an admirable idea of that most interesting country. Its great product, no doubt, will be indiarubber. It is a subject to which I have given close attention during many years. Indeed, I introduced those valuable rubbers, the Para rubber (*Hevea*), and also the *Castilloa* of Central America, into India. I say those two rubbers are far superior to any rubbers from any other part of the world, but I believe the rubber of Africa comes next; at any rate, it will always fetch a good price. The trade will increase rapidly, the demand for it being enormous, and I cannot doubt in this respect there is a bright future for Liberia, and I am sure we must all wish success to those who are trying to open up the country. You will wish me to convey to Sir Harry Johnston a most cordial vote of thanks for his very interesting paper.

THE RUINS OF "HUANUCO VIEJO," OR OLD HUANUCO, WITH NOTES ON AN EXPEDITION TO THE UPPER MARAÑON.*

By REGINALD ENOCK.

DURING a recent journey I made a deviation of some leagues from my route on purpose to see and to examine, as far as time would permit, these handsome ruins. The plain of Huanuco Viejo, upon whose western verge the ruins are situated, is a remarkably level tableland, whose geological formation appears to be a quartzite and limestone conglomerate or compact gravel—at any rate on its northern and eastern edges—and the hills bounding those sides are vast cliffs of similar material, which I had hoped were auriferous deposits. The altitude indicated by my aneroid was 11,811 feet, and the temperature was not too cold to be comfortable, even in the tent at night. Sleep was, however, much disturbed from the necessity for continual vigilance in order to avoid the mules being stolen in the night. The plain has an exceedingly bad reputation as a resort of cattle-thieves and horse-thieves, and I was afterwards congratulated upon not having lost any of the animals by these midnight Indian robbers. My method was simple. Apart from keeping the arrieros awake, at any signs of fright upon the part of the mules—for they generally indicate in an eloquent manner the presence of a prowling robber—I lifted up a corner of the flap of the tent nearest my cot, and discharged a couple of revolver-shots into the night—a method which proved effective both here and elsewhere.

* For map, see p. 700, vol. 25.

On the following morning I started out early to examine the ruins, and found them very extensive. Unfortunately, the films of my little hand-camera had given out, and it was not possible to take photographs, but the sketches which accompany this will give a very fair idea of the architectural features of the ruins. Dimensions were obtained by pacing and compass triangulation, and it is not pretended that they are more than approximate. Most of the sketches were taken on mule-back, and were made as carefully as circumstances would permit.

The well-known Peruvian traveller of last century—Raimondi—visited these ruins, and in one of his works gives a brief description and a sketch thereof. The latter, however, is by no means faithful to the original. My friend, Doctor (of Laws) Cisneros, chief justice for the department of Ancacus, and who was Raimondi's companion in his travels in 1870, informs me, nevertheless, that they took careful measurements of these ruins, but which do not appear to have been published. In the work before mentioned Raimondi quotes from a previous historian, who states that "in March, 1533, Hernando Pizarro, the brother of the 'Conquistador' Francisco, arrived at the city of 'Guaneso.' It was a 'casa real,' or royal palace, built of large stones very skilfully set, and was so important in the time of the Inca that there dwelt there continually, for the service of the Inca, more than 30,000 Indians." The foregoing quotation I have translated from the Spanish of Raimondi.

The accompanying sketch (Fig. 1) will give an idea of the extent of the principal or central portion of the city. Beyond, nothing

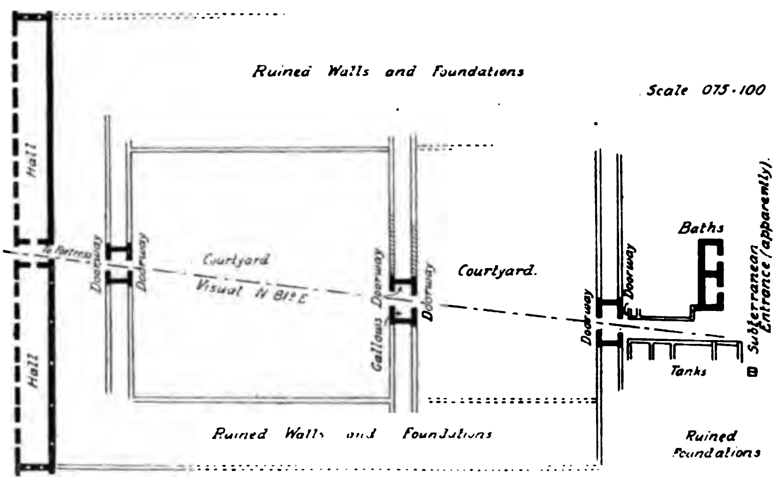


FIG. 1.—APPROXIMATE SKETCH-PLAN OF THE INCA PALACE.

remains but the foundations of numerous habitations. About a mile away, however, to the west, and built upon the limestone hills which rise from, or rather bound, the plain, are the foundations and streets and walls of what has been a very extensive community. These are described later (see Fig. 11).

The architectural features which are most noteworthy are the stone doorways to the palace, and the castle or fortress. I made careful measurements of one of these doorways, which are shown in Fig. 2.

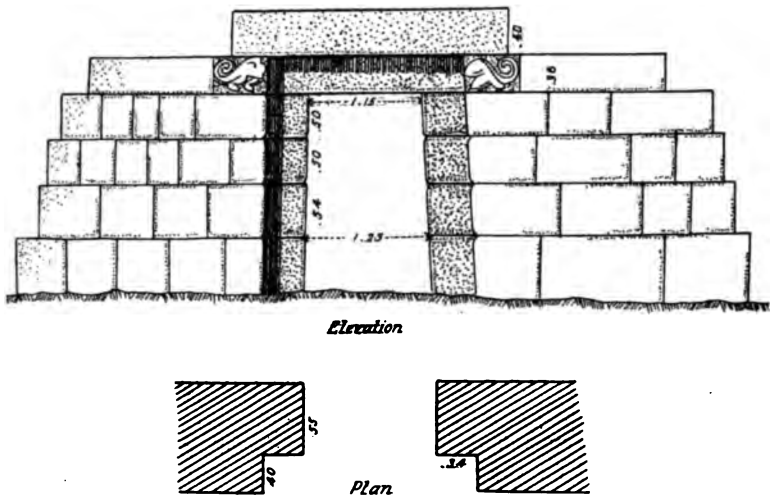


FIG. 2.—ONE OF THE DOORWAYS TO THE INCA PALACE.

The sketch Fig. 3 also shows the style of architecture. The stones which form this part of the work are very carefully cut and fitted, and it would seem that the builders have made up in laborious care and exactitude what they possibly lacked in skill or appliances. The stones have been worked, it is presumed, with copper tools, for the Incas were unacquainted, it is generally stated, with the use of iron. The joints of

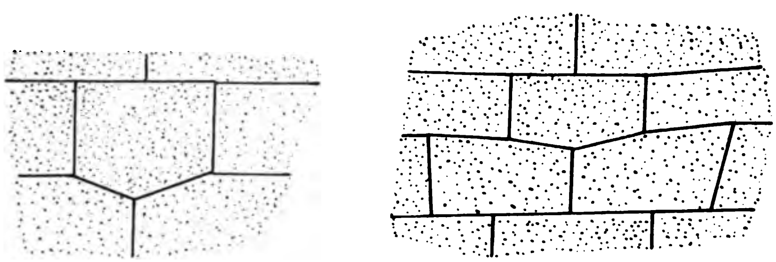


FIG. 3.—EXAMPLES OF MASONRY JOINTS, HUANUCO VIEJO.

the stones are so closely fitted that a knife-blade cannot be introduced, and no cement or binding material has been used. The bedding is not necessarily horizontal, nor the upright joints vertical, the stones having been cut to fit each other regardless of uniformity. Some of these stones are of large size, as the lintels, which are monoliths of more than 2 metres in length, and of the whole thickness of the walls. The stones which form the "reveals" are often rebated in order to form bond.

The walls generally are about 3 feet in thickness. The stones appear to have been set in place, and the next or following stone fitted laboriously to its companion, as previously stated. Bond is formed by stones which traverse the thickness of the walls. The carving of the capitals, like most Inca carving, appears somewhat rude, and represents generally either a scroll or a species of lizard, or "lagarta." I cannot help thinking that the Inca scroll has been suggested by the large petrified "ammonites" so common in the limestone formation of the Andes. I have spoken of the fossils in another part of this account.

The faces of the stones still show what are undoubtedly tool-marks, for the hard silicious limestone of which they are composed has showed no alteration under the action of the elements. Rather it has acquired with age a beautiful faintish red tint, and a distinct polish.

I have elsewhere spoken of the ruins of the castle of Chavin (Plate II.), which I also visited for the second time on this excursion, and in this connection may be mentioned a belief or supposition among the natives with regard to the formation of the stones with which that castle is built. They state that these stones have been modelled, not cut; that the Incas were acquainted with some herb, an infusion of which poured upon stone caused the latter to become plastic, when it was easily moulded into any required shape. It is stated that upon one occasion some individuals, having discovered a subterranean chamber belonging to an Inca dwelling, accidentally overturned an earthen vessel which they found there, and which contained some liquid. The contents, falling upon the floor, caused the stones of the pavement to become soft like "dough," and the aforesaid individuals, observing this, endeavoured to save a portion of the liquid, but without success. They then turned their attention to another similar vessel, which stood near by, also with a liquid, and, pouring a portion of this upon the stone, they observed that the latter resumed its usual consistency.

I do not know that there is any foundation for these suppositions, and only give them for what they are worth. The stones spoken of are, it must be added, certainly not formed of artificial material, as terra-cotta or concrete, but are natural stones.

In the east wall of one of the small chambers or passages of the palace exist two holes in the masonry, 6 inches apart, and about the height of a man from the ground. These, it is stated, were "gallows." A rope was presumably passed through these holes and around the neck of the condemned; the stones upon which he, or she

—for one side was for men and the other for women offenders—stood were then removed, and the latter left hanging by the neck.

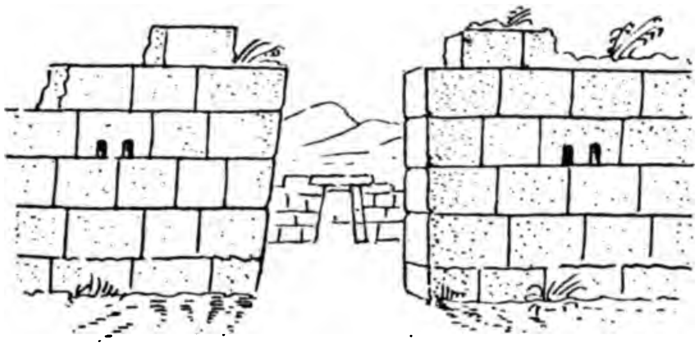


FIG. 4.—SUPPOSED INCA GALLOWS, HUANUCO VIEJO.

The "royal palace," if such it were—and there is no doubt that the Inca inhabited the place—is shown on Fig. 1. It consists primarily of two halls, each about 250 feet long and 30 feet wide, followed by two courtyards, to which access is gained by the portals or stone doorways shown on the plan. There are six of these doorways, all beautifully formed of cut stone, and all more or less alike. One of these is that shown in Fig. 2. They are of typical Inca style, with battered sides, and very solidly constructed. Possibly there is a suggestion of something Egyptian about them.

A remarkable feature about the plan of this edifice is that of the arrangement of the doors upon a "visual line." This may possibly have been accidental or undesigned, although I have heard it stated that it is the result of some certain purpose. The observer, standing at

FIG. 5.—RUINS OF THE PALACE, LOOKING EAST

the western side, or even near the fortress, has a clear view right through the openings, and in like manner from the eastern extremity—

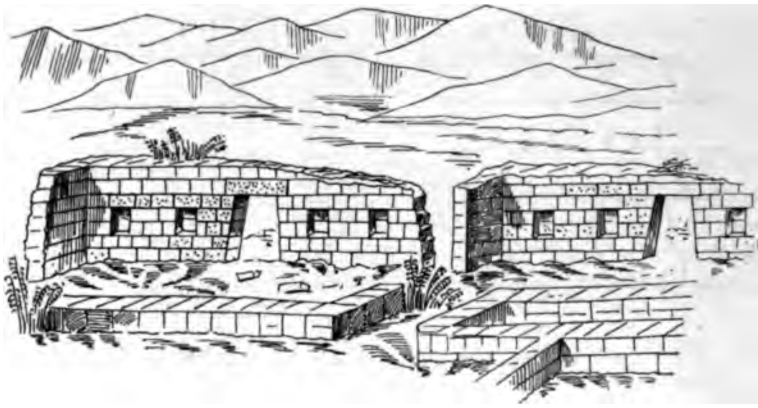


FIG. 6.—VIEW OF THE BATHS, LOOKING EAST.

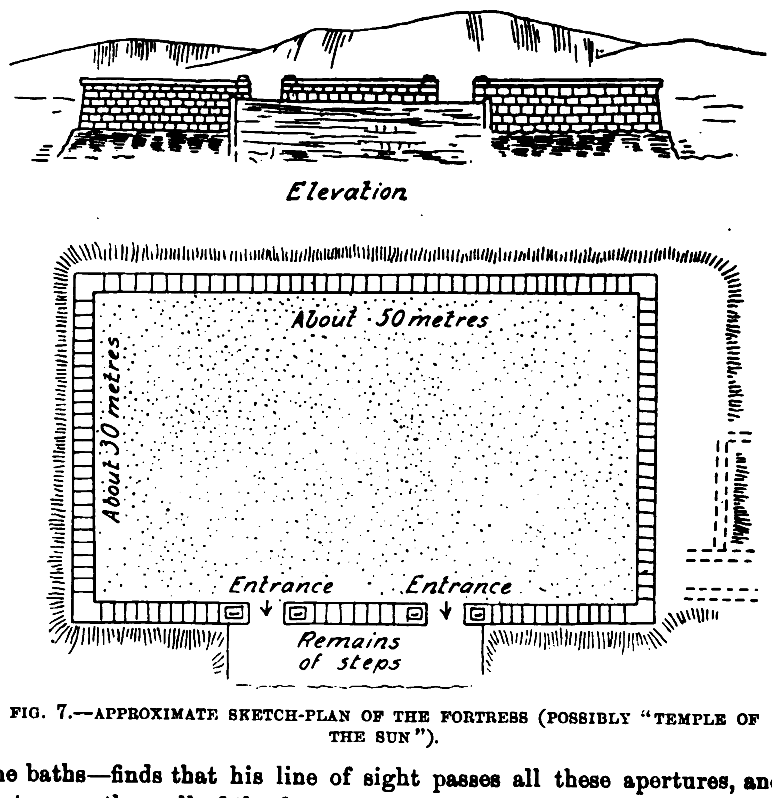


FIG. 7.—APPROXIMATE SKETCH-PLAN OF THE FORTRESS (POSSIBLY "TEMPLE OF THE SUN").

the baths—finds that his line of sight passes all these apertures, and rests upon the wall of the fortress in the distance. This is made clear upon the sketch (Fig. 5).

Only portions of the masonry are of worked stone; the rest are of unshaped, or very slightly shaped stones, but are nevertheless skilfully set and bonded. On the western face of the southernmost of the two "halls" are nine doors and window openings, occurring alternately, and on the other nine doors and no windows. On the eastern side are the baths, whose walls are all of carefully cut stone. These are shown on Fig. 6. All around this edifice are the ruins of numerous dwelling-houses, which, doubtless from their less careful construction, have not withstood, except in some cases, the destructive action of time. Moreover, the native shepherds are continually removing the stones to form "corrals." It is not possible to determine of what the roofs of these buildings were composed. There are no vestiges of timber remaining, and the construction is not such as to suggest that they were of stone, dome-shaped.

The fortress, or temple of the sun, is shown in Fig. 7. It is rectangular in form; very solidly constructed of cut stone blocks sur-

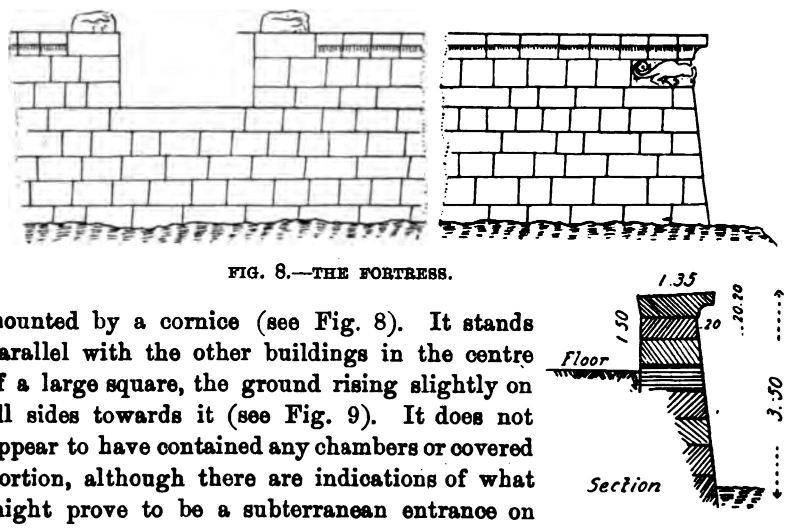
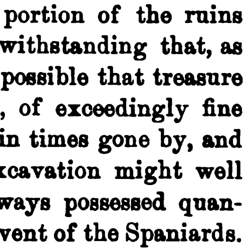


FIG. 8.—THE FORTRESS.



mounted by a cornice (see Fig. 8). It stands parallel with the other buildings in the centre of a large square, the ground rising slightly on all sides towards it (see Fig. 9). It does not appear to have contained any chambers or covered portion, although there are indications of what might prove to be a subterranean entrance on the east side. Neither here nor in any other portion of the ruins have there been any attempts at excavation, notwithstanding that, as this was one of the seats of the Inca, it is very possible that treasure lies buried. Some gold objects, I am informed, of exceedingly fine workmanship, have been accidentally discovered in times gone by, and I should consider it probable that search and excavation might well be repaid, for it is well known that the Inca always possessed quantities of gold, much of which was buried on the advent of the Spaniards.

The portion of the city separated from that upon the plain—or possibly at one time the intervening space also contained dwellings—is, as previously stated, situated upon some limestone hills to the west, and overlooking the fortress and castle. These hills, it may be noted, are of very marked stratification, and large quantities of limestone blocks have been removed, doubtless to build the city below.

As seen by the sketch-plan (Fig. 10), this community consists of a series of "streets," if they may be so termed, or rows of houses, where the street or passage was upon the upper side of each row. Some of the houses are circular and, in the lower rows, some distance apart.

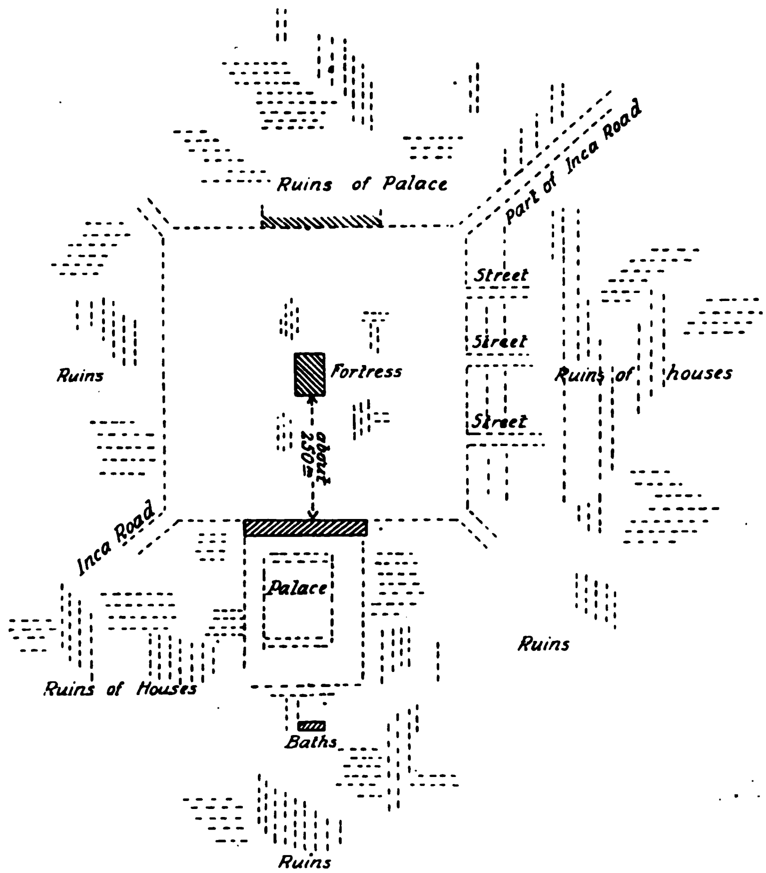


FIG. 9.—SKETCH-PLAN OF THE RUINED CITY. APPROXIMATE SCALE, 0·01 = 100.

Next above comes a row of circular houses only about 6 feet apart; still higher, square single houses, followed by several rows of square double houses. They are all about the same size—20 feet in diameter, or across the square. The walls are built of unsquared blocks of stone; the circular houses are true circles; the square with quoins at the angles, and with lintels roughly shaped over doors and windows. The stones are bedded in earth or mortar, all placed with care, and the interstices fitted with angular fragments of stone driven in. The walls are about 2 feet in thickness. A small door on the upper side, about 1 foot 6 inches square only, gives access, and a small window on the lower, light. Undoubtedly, security against attack or intrusion was the dominant note of their construction.

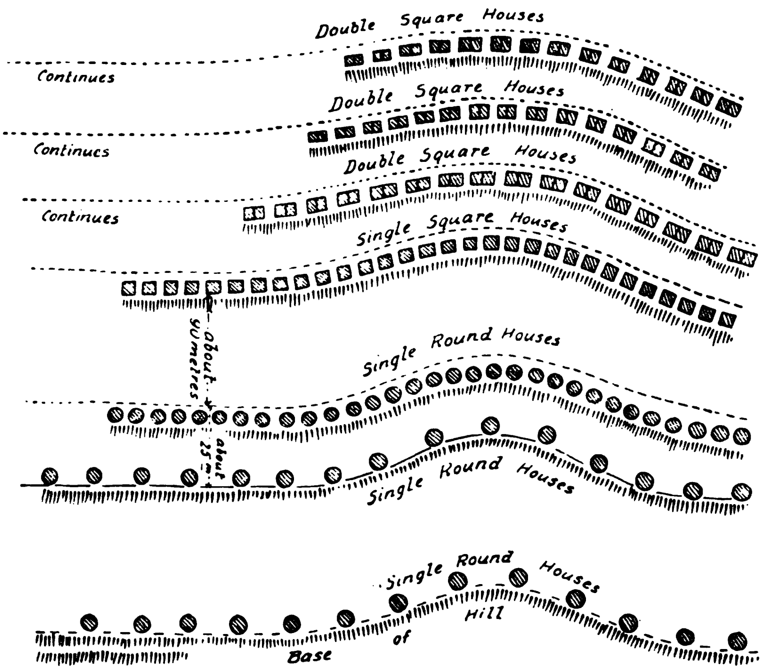


FIG. 10.—APPROXIMATE SKETCH-PLAN OF PART OF THE RUINS OF HUANUCO VIEJO.

I rode along these "streets" on mule-back, but time did not permit me to count the number of dwellings, of which there must be several thousand, as the rows continue for possibly 1000 yards around the hill to the south. There they stand, mute witnesses to a large population, which lived and moved and had its being in centuries past, and whose vestiges are now but—

> "Blown about the desert dust,
> Or sealed within the iron hills."

On the plan (Fig. 9) is marked the "Inca road." I followed this road for a short distance, and, in fact, portions of it still form the means of descent from the plain to the river Vizcarra, an arm of the Marañon. It passes down a steep ravine, and is formed of circular steps of unhewn stones. This descends to the river near the town of Aguamiro, or La Union, a distance of a few leagues, and passes the river Vizcarra by a bridge, only a portion of the original abutments of which remain. To the east of the ruins runs the river Marañon proper, beyond the hills shown in the sketch of the baths, looking east, and the Inca road continues to the river, crossing it at its exit from Lake Lauricocha, the source of the Marañon, by a well-preserved Inca bridge formed of slabs of stone.

Time would not permit me to devote more than one day and a half to the ruins, which are worthy of more study than I was able to give. Possibly I may have committed some errors in description; for example, what is generally termed the "fortress" may really have been the "temple of the sun," for such existed in the city. I was obliged to push on to the south to reach a point some 5 leagues away.

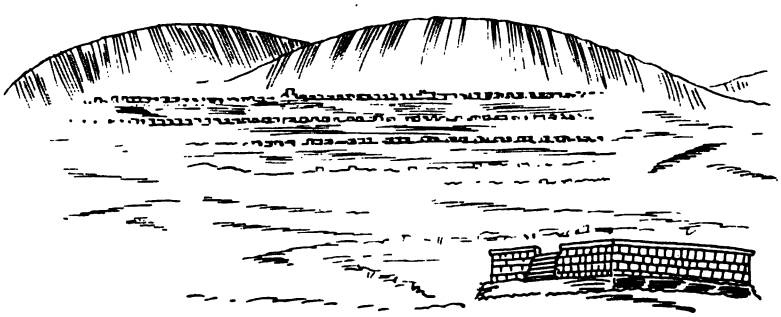


FIG. 11.—DISTANT VIEW OF CITY ON THE HILL, HUANUCO VIEJO. FORTRESS IN THE FOREGROUND.

and evening was falling when I gave the order to strike the tent and load the mules.

Very picturesque and impressive was the place as the long shadows fell across the tableland, the sun's disc nearing the western horizon upon the hills which crown the Vizcarra. The clouds, a scarlet curtain of rare and filmy texture, strove as if to hide his exit, and from below, rather than from above, appeared the shades of evening. Already far away appeared like dark spots upon the plain the forms of my mules, the cries of the impatient "arrieros" lost in the distance, and the only living beings upon the spot were myself and the mule I bestrode. Some attraction of contemplation, born of the influence of the dying day, held me momentarily to the place—contemplation of those old, sad vestiges of a perished civilization, for the ruined handiwork of man is ever fraught with serious cogitation to thinking man. That strange old monarchy, that industrious race, before whose habitations I stand! They are gone. What part have they played in the scheme of a universe, they whose only vestiges are these stones?

The light faded from the western sky; save that pearly tint of momentary beauty following the after-glow; and a single star, dominant of the horizon, gleamed like a pale jewel against the vault of heaven, whilst the purple haze below, which slowly grew to being, brought silence, night, and solitude. The breeze whispered among the deserted halls of the Inca; the wild oats growing above the entablature swayed softly, as if they murmured, "As a flower of the field so he flourishes; for the wind passes over it and it is gone; and the place thereof shall know it no more!"

As will be seen by the map, the Marañon divides near the town of Paches, one branch descending from the south, and the other from the south-west. The former is the Marañon proper, and at this point is only about 50 miles from its source—Lake Lauricocha. The latter is termed the "Vizcarra," and has its origin in the Cordillera of the Andes, near Huarapasca.

Almost the whole of the district described in these notes is included between the parallels of lat. 9° and 10° S., and is bounded approximately, on the east, by long. 75° 40′ west of Greenwich.

After leaving the town, and head of Province, of Aguamiro, upon the Vizcarra, I arrived at Huallanca, a small place which is of growing importance, due to mining development and enterprise. In this neighbourhood are very extensive deposits of anthracite coal in the quartzite formation, which in some near future time must cause this region to become important. Also the ores of copper, silver, lead, zinc, etc., are abundant. The coal formations are very marked, and in many cases stand vertically within their enclosing strata, which latter have been here very much upheaved and distorted. They tower up to a height of hundreds of metres above the river, and from their topographical formation so lend themselves to economical mining methods that undoubtedly Peru must some day become an important coal-producing country.

Leaving the Vizcarra on the west, near its headwaters, I arrived within a short distance of my objective point—Chonta, when a fierce snowstorm overtook us, and caused us to lose the track. On many of these mountain uplands, or "punas," interminable swamps exist, and across these we floundered for hours, on several occasions nearly losing some of the pack-animals. One of these almost disappeared with its load in a treacherous place, and was only saved by superhuman exertions. Shortly afterwards another, in crossing a bog, went down, and in struggling overturned its load of provisions and utensils. Freeing itself partly, the animal bolted, dragging after it its burden, and disappeared, in spite of our efforts to stop it, around the base of a hill. Whilst the muleteers pursued it, I rode over the track "locating" the utensils, such as pots, the frying-pan, cups, spoons, packets of flour, sugar, and coffee, and divers such articles, which were strewn among the snow. Night was upon us; there were no habitations and no fuel in the vicinity, for the only combustible in those high "punas" is the dried grass. There was nothing for it but to face circumstances as they were, and I gave the order to clear a space from the snow and plant the tent. The altitude was more than 15,750 feet, something less than 3 miles vertically above sea-level! The icy blast blew through and through us, and the water poured in beneath the bottom edge of the canvas. Just previous to this my mule had slipped and fallen, rolling on to me, not doing me more injury, however, than that of a broken finger, the pain of which by no means detracted from the discomfort which I experienced.

But the traveller who has chosen the winter time for his travels in the Andes, against the advice of his friends, must make light of the consequences, and I ordered a trench to be dug on the upper side of the tent, which prevented the water entering and further wetting the bedding, etc., whilst the snow shortly covered the canvas to a depth of a foot and afforded protection from the cold. A small alcohol lamp which I carried for emergencies, afforded the means of making coffee, and I was able to obtain a few hours' sleep; my only preoccupation being for the unfortunate mules, who, exposed to the gale, found but little fodder for the depth of snow.

My three "Cholos," who had been my only companions during this arduous expedition, resisted uncomplainingly the hardships they were called upon to suffer. Wet to the skin and exhausted with the pursuit and capture of the mule, they nevertheless put forth every effort towards securing the comfort of the "patron," for I have always been fortunate in being able to attach these faithful fellows to me by simple methods of strict justice towards them.

On the following day all my hardships were forgotten and rewarded on the examination of my concession in Chonta, which proved to be of great value. It embraces a large area of cinnabar-bearing formation, and may prove to be one of the most important quicksilver mines in the world.

The altitude is 14,600 feet, and the place is stated by Raimondi, in his work published in 1874, to be "one of the highest inhabited places on the globe." The mines were discovered in 1756, owing to an order by the Crown of Spain for the search for new quicksilver-mines, and in the past have produced a great deal of this metal.

From Chonta I obtained a view of the hills which bound Lake Lauricocha, the source of the Marañon, only about 20 miles distant from where I stood, and on the south-west arises a magnificent series of snow-capped peaks, whose name I was unable to obtain. I could not sleep here during several nights, owing not so much to the cold as to the exceeding rarefaction of the atmosphere. The organs which are affected, however—the heart, the lungs, the brain—soon accustom themselves to their environment.

It was a source of much regret to me that I was unable to arrive actually at the lake, but it was impossible. My men were worn out with constant exposure, and ill with "tercianas," or intermittent fever, and could no longer endure these high altitudes. The mules were not in a condition to pass the swamps between us and the lake, for the roads, due to the exceptionally rainy season, had become converted into such, and the only fit member of the party was now myself. However, I have to visit the region again shortly, and in the proper season these difficulties do not occur. But I beheld the blue hills above the lake as a sort of "promised land," to which I had been denied admission.

From this point I began my return journey to Huaráz, passing the summit of the Andes again at another point—the pass of "Huarapasca,"* altitude 15,666 feet. The end of March was approaching, and the expiring winter seemed bent upon expending its last fury upon the head of the traveller who had defied it in its stronghold. For eight long hours, as I passed the summit, the wind and snow and sleet came out of the west in long horizontal lines, converging, apparently, upon the track where I descended. For eight long hours we plodded on without once descending from the saddle, except for an instant near the summit to rearrange the pack-mules' burdens. Between those tearing tempest-clouds the sun flashed out for one brief moment, lighting up that labyrinthine wilderness of eternal snows, the roof of the world, and flinging strange shadows upon the appalling terraces of that vast solitude.

It was but a brief respite. The thunderclouds gathered in front, the lines of descending snow again increased their vigour, and the winter lightning flashed. The gathering volume of the stream in front of me, which formed the "road," hissed angrily as it brushed aside the pebbles in its path. The scene was changed again. "And such a change. Oh, night and darkness, thou art wondrous strong!" For the Andean night closed in, and the weary pack-mules could scarce advance. A shepherds' cottage—incredible that these people live at such an altitude—gave shelter at length, and permitted the preparation of some "breakfast," for it was the first meal we had been able to partake of.

But I could not sleep. The cold and the rumbling of the avalanches on the peaks behind the house drove sleep away.

At 5 a.m. I stood outside the wretched hovel. Will the morning never come? The cold is intense, the breeze freezes my finger-tips and ears, and scarcely the faintest gleam comes from the snow beyond. Will "the day-spring from on high" never visit us? It comes as I stand there! In the east a faint light appears through the driving snow, and from behind a distant hill a tearing veil of cloud makes way for a lake of blue, and in an instant closes again as if reluctant to release the firmament from its dun dominion. Will day never dawn? Again the icy breeze blows past, and I feel faint for lack of food and

* Pronounced Whā-rā-pas-ka.

sleep. "Get up, lazy animals, and make my coffee!" This to the sleeping "cholos," who roll over and arise.

At last the day. I do not wonder that the ancient Incas worshipped the sun. A beam shoots upward—the arm of the sun-god, a sunbeam, and banishes the hungry clouds of night. It grasps the veil of darkness and hurls it aside; the mists roll off adown the valley; the eternal snow upon the everlasting peaks fast tinges with a rosy light; the tint is reflected, is flung into the western sky; a bird twitters among the grass and snow. It is day!

We journey onward and downward. The formation is limestone, and I halt for a moment to sketch a huge fossil "ammonite," which stands facing the road like a stone carved with an Inca scroll.

FIG. 12.—FOSSIL AMMONITES IN THE ANDES, 14,764 FEET ALTITUDE.

The number of these fossils at this point is remarkable; they stand in rows like an arrested and petrified "school," in marked vertical strata, or series of strata, which run north and south. Their diameter, or at least that I measured, was 2 feet 8 inches across the curved portion. The nucleus, or central portion, appears to be better preserved than the rest, and hundreds of these centres, in the form of flattened spheres, strew the track as it runs across the formation.

Still we descend, and the streams now flow westward, carrying their *débris* to the Pacific ocean. The traveller is witnessing in these heavy storms the formation of new "horizons," and, relatively of course, the Andes are being worn away before his eyes. The head of a valley is reached, and I am tempted to sketch some of the natural "reservoirs," or lakes, the remarkable symmetry of whose enclosing moraines seems the work of man in an artificial embankment. Some of these are 160 feet high.

There are three cordilleras to be passed by this route, that is to say, three "undulations" of the cordillera, and after two days' riding we descend to the plain or "pampa" of Lampas. This plain, which is some 10 leagues broad, is remarkable for its exceeding flatness,

HEAD OF QUILCAY VALLEY, NEAR HUARÁZ.

PANORAMA OF HUARÁZ, LOOKING EAST.

stretching away before the view of the traveller to where its horizon-line cuts the base of the hills which bound it. It is of a gravel formation, partly auriferous. On its south-westerly side is Lake Concoocha, the source of the river Santa, which, as before stated, flows north-westerly to the Pacific ocean, down the valley of Huaylas. The hills above this lake are of somewhat remarkable forms of volcanic rock, and various metalliferous ores are found there. The altitude of this plain and lake is 13,124 feet.

From this point to Huaráz the road follows the verge of the river, a distance of about 16 leagues, passing in turn the towns of Ticapampa and Recuay, where a good deal of mining—principally silver ores

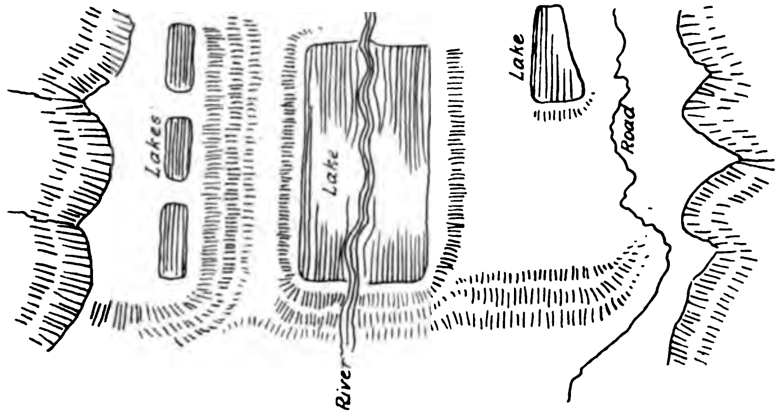


FIG. 13.—NATURAL LAKES IN ANDEAN VALLEY (TERMINAL AND LATERAL MORAINES).

—is carried on. The river was in flood below the lake where we passed, and one of the mules was nearly carried away. A survey has been made for a railway along this valley to Chimbote on the coast, and would undoubtedly form a paying enterprise.

The buildings and towers of Huaráz, as I approached it, seemed, after the primitive places where I had sojourned, to form a "grand metropolis," such is the effect of comparison. The panorama (Plate I.) gives an excellent idea of the city seen from afar. I was glad to arrive. I was weary of battling with the elements; my mules were in need of rest and good fodder; my men anxious to be with their families. My spurs were worn down to the rowels, and my indiarubber cape absolutely rotten with continued wettings; and the prospect of a comfortable bed, clean surroundings and good food, and other usual adjuncts of civilized man, were most alluring.

The religious processions in Huaráz, for the "Semana Santa" (holy week), were near at hand, and in these interior towns of Peru the ceremonies of the Church are carried to extremes. These matters, however, are principally perpetuated by the priests and the Indians, the upper class standing aloof. Life-sized figures of "Jesucristo" and the soldier-executioners are arranged on a large platform, and borne through the streets on the shoulders of Indians. In this connection, it is to be observed that the Indians do not reverence these images as such, but declare that they are the *actual personification* or embodiment.

Religious objects of the Incas were recently discovered close to Huaráz, in a subterranean temple, part of which still remains. The objects were found upon an altar of curious conical form, having beneath it an apparatus for acoustic purposes. They consist principally of discs of gold, silver, and copper, tied together with a ribbon of gold, strong and flexible; cylinders of the same metals, similarly secured; shells formed of delicate leaves of gold; two porphyry figures representing some animal—bull or lion; and two sea-shells.

The occurrence of the three metals mentioned, which always appear among Inca traditions in the neighbourhood of this part of Peru, has a special signification. The Incas of this region were not necessarily sun-worshippers, but adored an imaginary being, whom they termed "Vira-cocha." There was no tangible representation, exactly, of this deity, and the translation of the word signifies "lake-foam," the idea being to represent something beautiful, ideal, pure, and intangible, yet real and possible. The Indian word *Misti*, which in Spanish is rendered "caballero," was also used to convey the sense desired, and the only possible word in English which could express this idea is "gentleman," but in its highest and true sense. Their "god," therefore, was "a gentleman," and it must be conceded that not many higher ideals have existed among the beliefs of the nations of the world.

To return to the gold, silver, and copper. The "genesis" of these people, or history of creation for them, was that there fell from heaven in ages past an egg of copper, from which, upon its reaching the earth, the first Indians issued. After a time a second egg fell, of silver, from which sprang the "Nushtas," or nobility; whilst again, after a long lapse of time, a third egg, but of gold, also fell, and from this came forth the Inca. It is to be observed that the "sacred number" of three is represented in this genesis.

To conclude, I have only lightly touched on the inexhaustible and interesting field which this part alone of Peru offers, and the territory which I have endeavoured to describe is but a portion of the vast area of the republic.

THE UPPER MARAÑON.

SOME NOTES UPON AN EXPEDITION THERETO.

Towards the end of March, of the present year (1904), I returned to Huaráz from an expedition to the upper Marañon and the region bordering thereon. The primary object of my journey was to examine and take possession of some gold and quicksilver-bearing concessions, which I had acquired previously; but in addition I desired also to study, as far as time would permit, the general geological conditions of the district, as well as to become acquainted with the ways of the natives, and to visit some of the numerous ruins of the bygone Incas, which exist in great abundance there.

In a paper recently read before the Royal Geographical Society (*Journal*, vol. 25, p. 620), I gave a brief description of my passage of the Andes near the city of Huaráz, and some photographs which accompany this account will enable an idea to be formed of the character of the region I traversed. Unfortunately, some of the best of those which were taken *en route* were spoilt by the breaking of the negatives, and could not be reproduced. I also spoke in that paper of the peak of Huascaran, which towers upwards in its rare splendour slightly to the north of Huaráz. The name of "Huascaran" was given to the mountain by Raimondi; its real name, and that by which it is known among the Indians of the vicinity, is "Mata-raju," which means "the double point of snow," for it presents two peaks.

It has not been the writer's good fortune to know, with the exception of the Sierra Nevada of California, and the snow-capped volcanoes of Mexico, any of the great mountain ranges of the world other than the Andes, which he has crossed some seven or eight times, and therefore he is unable to make comparison therewith. Other travellers have doubtless decided as to the relative grandeur of the world's mountain-chains, but the varying magnificence of the Andes, with the changes of form due to different geological formations, must ever command the admiration of the beholder.

I have always the feeling, when standing on these stupendous summits, of being "on the edge of matter." What are they for, these edges and films and threads of snow, pointing upwards; these strange saw-teeth with which the world seems to be ploughing its way through these huge soft masses of cumulus vapour which extend before, beyond, around, and below me? I seem to stand on the top of this sphere, and to feel it floating in some sustaining medium!

Between two rock-masses below the summit of "Mata-raju" our trail passed in the descent of the eastern slope (16,076 feet). Night was beginning to fall, and we sought shelter in a spacious cave in the valley below.

The out-of-the-world town of Huantar is one of the most primitive places that can be imagined; the chief feature about the inhabitants is the prevailing deformity known as "coto," or technically "bocio,' and consists of an enormous double swelling of the neck, which hangs down like great pouches. This strikes pity and disgust into the mind of the foreigner, especially when it is known that the disease has its simple remedy in the use of iodine, and results solely from negligence and lack of initiative on the part of the better members of the community. Here is a field for a self-denying doctor, who would sacrifice himself to dwell among these poor and backward inhabitants of this district.

Near this town are numerous ruined habitations and fortresses of the "Gentiles," as the present inhabitants of Peru term the ancient dwellers of the country; and in the quartzite formation are numerous silver and silver-lead mines, which, however, are scarcely worked by the modern Indians. Some veins of bismuth are also encountered near here; coal too occurs. The name of this town is derived, I was informed there, from a corruption of the Spanish words "Aguantar ó Reventar," meaning literally "Suffer, or burst;" this having been the mandate of the Spaniards in that neighbourhood, who forced the Indians to abandon their dwellings in the almost inaccessible hills and to form a town on the plain below, the actual site of Huantar.

At the foot of the Cordillera is the castle of Chavin. These ruins are of much interest, and worthy of study. They are quite extensive, principally subterranean, and have been built of squared stones carefully set. I had but little time to examine these ruins, intending to return later. The portion I examined consists of a series of small square underground chambers, communicating with each other by passages, and also by curious small horizontal "shafts," not large enough to admit the body of a man. It is stated that below these chambers exists a similar series; and certainly, upon looking down a hole which had been formed, accidentally or by design, in one of the passages, a space or chamber was apparently observed. It is difficult to know what purpose these apartments served; possibly they were dungeons. In one of the passages is a stone column with characteristic Inca scroll carving upon it, circular in form, forming a monolith of considerable size. Some time ago efforts were made to extract this stone, but it was found that it penetrated the ceiling of the passage above, and extended downwards to an unknown length, and absolutely could not be moved. In the park of the exhibition in Lima is a large circular "calendar" stone, which was taken from these ruins and conveyed thither. I repeat that these ruins are worthy of serious examination, and some work and excavations would undoubtedly disclose matters of interest, and possibly unearth some treasure.

Close to the castle is a bridge, which was built by the Incas,

INCA RUINS AT CHAVIN.

INCA BRIDGE NEAR CHAVIN.

spanning a stream which descends from the Cordillera. The principal feature of this structure is that the floor is composed of single slabs of stone from 12 to 16 feet in length. The photograph of this bridge is somewhat defective, but an idea may be formed of its structure thereby. The four pillars at the corners are modern, and the carved stone heads built therein were taken from one of the subterranean chambers of the castle, and are good examples of Inca carving (Plate II.).

In Huantar I lodged as the guest of the "governor," or "gobernador," the petty authority of the place. I there observed the method by which the Indians make their complaints or "state the case" in any question they may have to lay before him. Before presenting themselves, they arrange the formula in which the plaint is to be delivered, concocting certain phrases which they deliver, all speaking at the same time, the same words, in a monotone, reiterating the phrases without any pause; this in the "Quichwa" dialect, and it lasts some ten or fifteen minutes, during which the "gobernador" listens patiently and judicially, and then announces his decision. The complainants may, for example, have come to supplicate for the release of some friend or relative who has been confined in jail for some petty theft or misdemeanor, and the plaint may take this form: "Tete" (father), "permit that our dear relative be released; Tete, permit that our dear relative be released; Tete, etc., etc.," *ad infinitum.* If any one of them fails to perform his part in the chorus, or has done it perfunctorily, the rest, upon leaving the presence of the authority, fall upon him and thrash him soundly with sticks, saying, "Thou hast not fulfilled thy part; thou art useless."

In these remote towns, the Church and priestly influence plays an important part, and both are matters of wonder to the foreigner. The edifice, which is generally built in a primitive manner of "adobes," is stocked with gaudy images and tinselled trappings of every description, crude and grotesque. The day I visited the church of Huantar was some saint's day—I forget which—and the building was filled with vegetables and earthern pots of "chicha," the native drink made from maize. These were not, however, presented as a "harvest thanksgiving," but were placed there in order that "the spirits of the departed might not suffer hunger;" and really, in the belief of the donors, the comestibles were to satisfy the hunger of their relative who had died, wherever they might be imagined to be at the time. I met one old Indian woman as I left the building, staggering under the weight of an enormous earthen jar of this beverage—chicha, and to my question she replied, in broken Spanish, that her beloved husband had been fond of "chicha" during his life, and that she feared he might be in need of the same refreshment now! It is a fact that the priests permit and even encourage this superstition in some places, themselves making use of the articles afterwards. When I mentioned this matter to the "gobernador," he professed to be very indignant, as it was "against the law;" and he made a show of going—as he said—"to have the whole church cleared out." I suspect, however, that this was only for the benefit of the "Ingles," and this suspicion was strengthened on partaking of part of a fat fowl at table later, which I recognized as having seen in the temple!

To describe the remarkable customs and superstitions of these poor and backward people on the eastern side of the Andes would occupy too much time and space. They inspire me with pity. "Knowledge to their eyes her ample page, rich with the spoils of time," unrolls so infinitely slowly for them. They have the weight of centuries upon them, dragged down by the chain of deadly ignorance, inheritance of their Iberian conquerors.

I have accomplished the journey from Huaráz to Chavin in one day, but it is a very hard day's ride. The distance is only about 14 leagues, but the main range of the Andes has to be passed midway, and from Huaráz one rises from 9908 feet to 15,256 feet, the summit of the pass of Yangshallas, and descends again to 10,500 feet at Chavin, a steep and trying "road," where a horseman is generally pelted for hours with drifting snow, and chastised by the bitter blast.

Beneath this summit, by means of a tunnel, would pass the Pan-American railway, according to a survey made some years ago. Although the summit of the pass is above the perpetual snow-line, it is a rather remarkable fact that the snow-cap does not cover the road, notwithstanding that it lies on either hand at a distance of a few hundred metres. I have been informed by the natives that the snow-cap existed here formerly, but that "the snow disappears always from the immediate vicinity when there is continual traffic," presumably due to the continued presence of living beings. Whether the hypothesis is well founded or not I am not prepared to say; but it is to be noted that the same fact has been observed on other passes which cross the same range; for example, that of "Huarapasca," some leagues to the south, which I speak of later.

The formation here is limestone, which stands up in enormous vertical strata, and numerous small lakes occur, generally presenting the appearance of having been artificially dammed up by embankments, which are really moraines left by the retiring snow-cap. In this connection it may be observed that, according to the observations of the people of the region, the perpetual snow-cap has retired and diminished very notably during last century, at least upon this portion of the Andes.

I have again to confess that the photographs taken here were not a success, and I must have recourse to my note-book for a sketch of the formation (Fig. 14). Nearing the summit the roads are formed by a series of rude steps excavated in the rock, or piled up of flat slabs of stone. In the background on this particular summit are peaks of pronounced and often curious form, and the contrast of the marked stratification of the rock and the dazzling surface of the snow is striking.

The lake-formation near the summit is interesting as showing the probable origin of springs in the regions below, the thawed snow entering the lines of cleavage of the vertical strata, and being conducted thence to lower levels.

These "appalling ramparts" of nature tower heavenwards at all angles, and frown down upon the narrow way in stern rigidity.

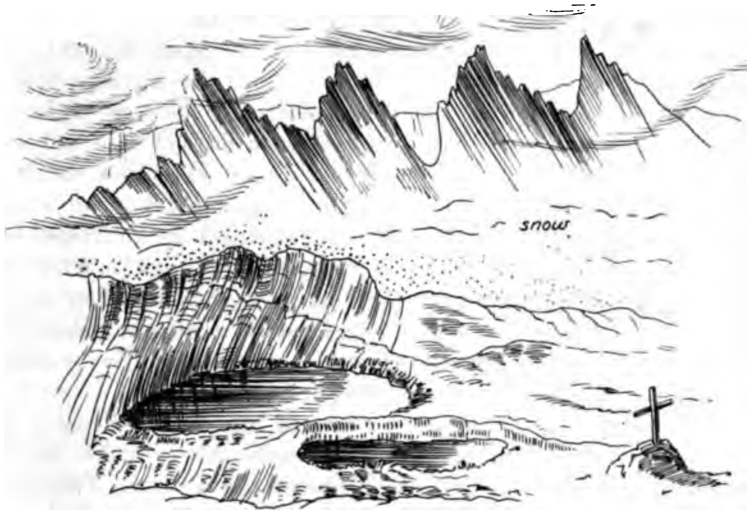


FIG. 14.—SUMMIT OF THE ANDES, SHOWING STRATIFICATION AND LAKE-FORMATIONS 15,256 FEET.

The small lakes in the sketch are exactly at the summit. On the left-hand side (the east), the waters of the melting snow gather in streams, and descend to the tributaries of the Marañon, finding their outlet a thousand leagues away, by the Amazon, upon the Atlantic coast. On the right-hand side they flow to the river Santa, and debouch at Chimbote in the Pacific ocean.

At the foot of the Cordillera exist some thermal springs, which the inhabitants of the village of "Olleros" use—very occasionally, I suspect, judging from their appearance—as baths. This village is on the western side, and is chiefly famous, or rather infamous, for its cattle- and horse-thieves. I had the satisfaction of seeing a gang of these individuals taken into custody. Many a sleepless night have this fraternity caused me and my men on these roads of the interior, necessitating constant vigilance to avoid the robbery of our animals.

I observed that wooden crosses were placed at the summits, and, in fact, the sacred emblem is in evidence in Peru even in the most inaccessible places, as, indeed, it is throughout Spanish-America generally. Whether it be to indicate a summit, to mark the leagues on a mountain road, the position of a spring or well, or to hold in reverence the wayside spot where some tragedy has occurred—for whatever object it be, the devout Indian has not failed to preserve it there, where it stands in silent sentiment; it confronts the view, and from the chance wayfarer—

"implores the passing tribute of a sigh!'

and no hand, however ruthless, thinks to disturb it.

But the cold and inhospitable summits of the Andes are past, and I have planted my tent on a green meadow where the Marañon rolls by, where the warm rays of the sun fall comfortingly upon us, drying our clothes and bedding, long wet and heavy from days of rain and snow. The famous river at this point is small, and resembles rather an English river, whilst overhead are the azure expanses and cumulus cloud-masses of a "Devonshire" sky. The valley slopes are cultivated with maize and potatoes, and numerous villages on the banks, with their white walls and red-tiled roofs, give at a distance an air of smiling prosperity. This latter characteristic, however, always vanishes somewhat upon entering the streets, when the poor and primitive method of living of the inhabitants becomes evident.

I have passed in succession the towns of San Marcos, Puntou, Punchao, the village and bridge of Chuquibamba, above which the first view of the Marañon is obtained, Chavin de Pariaca, Tantamayo, Yanas Pachas, Ovas, Silyapata, and others whose names and altitudes are recorded in my note-book.

All these towns, or rather villages, are more or less of a similar type. They consist generally of a small "plaza," or public square, with the temple on one side, and the streets radiating therefrom after the usual Spanish-American style, which is too well known to require description. Here the houses are of "tapiales," a construction in which the earth, wet, is rammed in between planks set upright, so forming walls, after the style of concrete construction.

The bridge of "Chuquibamba" is on the road to the "Montaña," or tropical interior of the country. The bridge is a primitive affair formed of logs covered with twigs and soil, before entering upon which the prudent traveller will alight, lest the horse or mule he bestrides break through the fragile covering with its hoofs. The altitude of the river at this point is 9023 feet above sea-level; the climate is generally mild, and might be compared to that of the south of England. The width of the river is generally about 90 feet here, but at the bridge narrows between the outcropping rocks to a few feet, the channel, however, being correspondingly deep, as shown by the following section :—

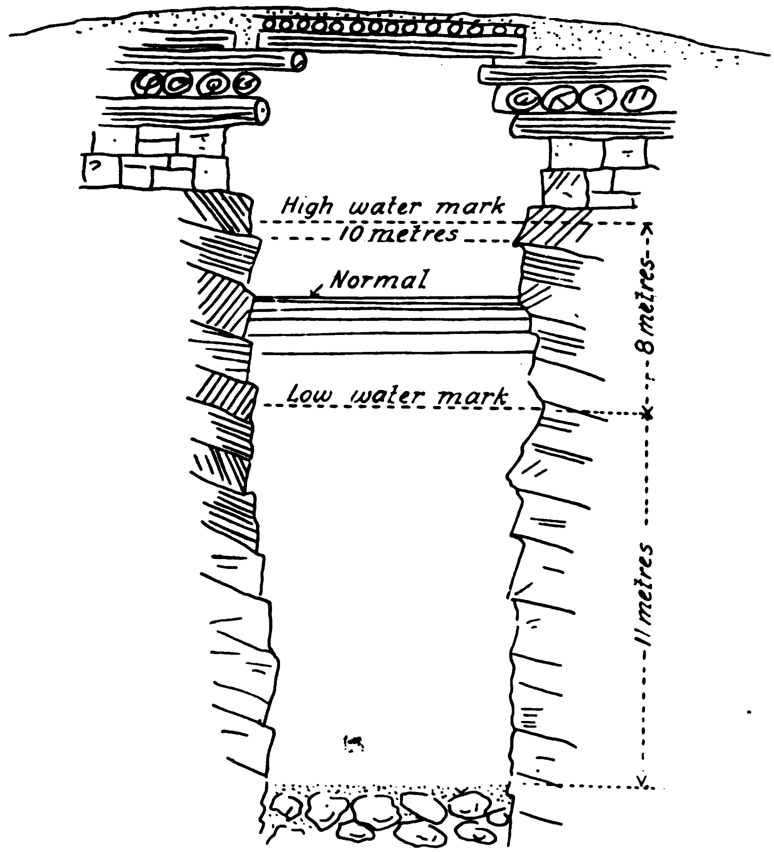


FIG. 15.—CROSS-SECTION OF RIVER MARAÑON AT CHUQUIBAMBA.

The flow of the current is swift at this point, and I was nearly carried away on one occasion whilst swimming in a pool above the bridge. The flow, or volume, according to my gauging in January, was approximately 1000 cubic feet per second.

The river is famous at this point above all for the occurrence of gold in its bed, and, in fact, the principal occupation of a number of Indians here is that of gold "washing," or extraction, both by men and women. I have personally obtained gold-dust and small nuggets from the gravel at the verge, and, in fact, a portion of my concession covers this part of the river. I have purchased from the Indians on several occasions nuggets of gold weighing up to half an ounce, and there is not the least doubt that great wealth is contained here. Below the bridge the river widens out into a species of "whirlpool," which, according to the Indians, contains a vast quantity of gold, deposited by the current. Years ago some persons endeavoured to examine the bed here by means of a diving-suit, and I am informed, but have not been able to vouch for the truth of the rumour, that one of them perished beneath the waters.

The geological formation of the valley of the Marañon (Fig. 16) in this region is a talcose slate, occurring in thin bands alternately with quartz, the latter generally stained with limonite. The formation has been much twisted, folded, and contorted, probably by "end pressure," and the quartz is an "after deposition" between the laminæ. On the western summit of the river-valley is a capping of white sandstone, and on the eastern of red slate-quartz conglomerate. The river-level is far below these summits, as indicated by the respective altitudes on the following section :—

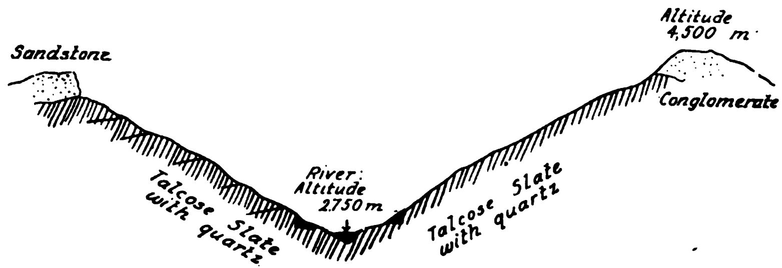


FIG. 16.—CROSS-SECTION OF THE VALLEY OF THE MARAÑON, NEAR CHUQUIBAMBA, LOOKING NORTH.

The black portions shown slightly above the river represent auriferous gravel deposits, laid down in previous epochs at a higher level.

Leaving the river, I had proceeded eastwards towards the "Montaña," arriving at the lakes of Carpa, only a few miles from the tropical region of Monzon, where there exist several factories for the production of cocaine. About 85 per cent. of the alkaloid is pure cocaine, and is extracted from the leaves of the "coca" plant or shrub, which flourishes there in abundance; altitude, 5250 feet. The lakes of Carpa are very picturesque, and of some considerable size. The altitude is 11,483 feet.

In the neighbourhood of the village of Tantamayo, about 4 leagues from Chuquibamba, are numerous old Inca ruins. In fact, all along the road from that point to the village mentioned are the remains of the fortresses of these people, crowning almost every hill. Opposite Tantamayo is a remarkable row of square towers on the summit of a hill, and as I passed they stood outlined against the evening sky, weird and romantic in their almost inaccessible abandonment. A little further on the ruined walls and towers of a whole ancient village presented themselves to view at a turn of the road, massed on a sombre ridge on the opposite side of the valley. Above rolled the sombre night clouds; below rolled the folds of mists which arose from the Marañon, 6500 feet below—the white fleecy mist which only the mid-day sun dispels—

"Slow lingering up the hills, like living things."

Near at hand a ruined castle stands, such as might have appeared to the lonely watcher in "the valley of St. John," where Triermain hurled his axe!

In the gorge to the left hand runs the Marañon, but far below. The view is exceedingly picturesque at evening, but the writer is

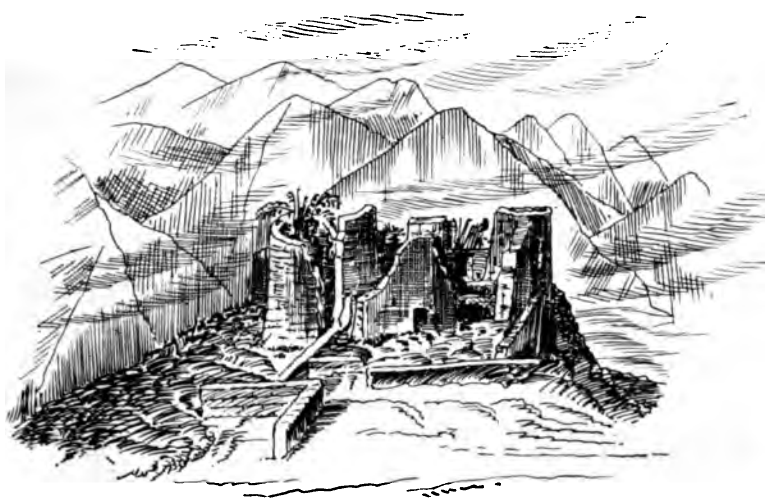


FIG. 17.—REMAINS OF INCA CASTLE, NEAR TANTAMAYO (A FORTRESS ABOVE THE CLOUDS).

unable to do it justice in the hasty sketch made in passing. However, an idea may be formed of the remarkable positions in which these edifices were constructed, and the very considerable altitude at which their inhabitants dwelt. Judging from these ruins, it would seem that these people dwelt in constant fear of attack, and, in fact, it is well known that the population consisted of numerous divided tribes, who constantly made war upon each other. The ruins are nearly 16,500 feet above sea-level, and the clouds are actually both above and below them, a situation which is almost appalling. Notwithstanding their altitude, however, there is no perpetual snow in these situations, and the hill-slopes have at one time been cultivated. There is nothing which arrests the attention of the traveller in the Andes more than the peculiar aspect which these interminable slopes present, due to this anterior cultivation. At first sight he is unable to explain the remarkable "ribbed" appearance, until he sees that it is the result of the formation of innumerable "terraces," which have previously been small plantations or fields, partly excavated on the upper and embanked on the lower side. These "antes," or "andes," as they are termed, have given rise, as is generally known, to the name by which the Cordillera of South America is designated. Moreover, the evidences of a very large anterior population is before the traveller, in that in most of these extensive regions every possible square foot of ground is so terraced, and has been at one time cultivated, however inaccessible it may appear to be. Also the very extensive ruins of habitations bear witness to a numerous people, whose customs and methods appear to have been subordinated to the rule of some absolute, yet apparently prosperous, monarch, or other individual ruler.

These extensive remains scarcely excite the notice of the present native inhabitant of the country. When questioned as to their age or purpose, he simply replies that they are "casas de los gentiles,"

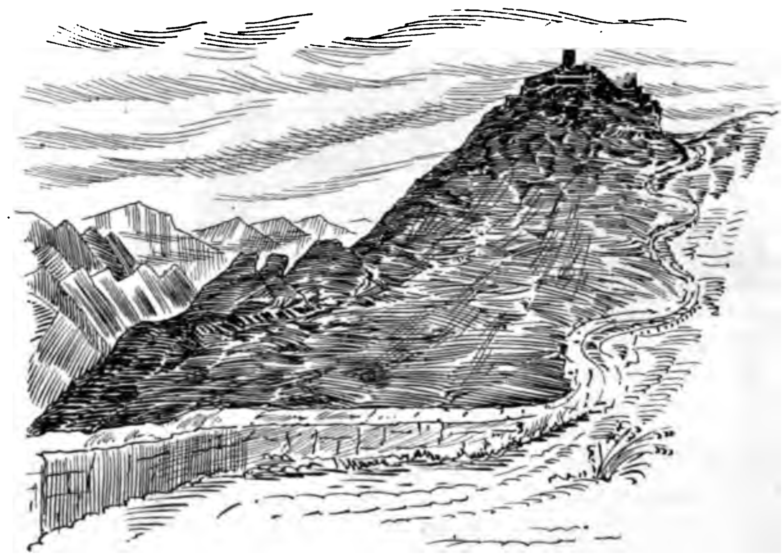


FIG. 18.—RUINED INCA FORTRESS, ROAD TO TANTAMAYO. GORGE OF THE MARAÑON ON LEFT HAND.

("houses of the gentiles"), which is the extent of his archæological knowledge. He does not even search or excavate in the hope of finding buried treasure, for superstition so bids him reverence these ancient dwelling-places that he almost fears to enter them, and fear, combined with lack of initiative, operates against any exploration.

The river is so far below that, notwithstanding the roar of its torrential passage, only the faintest murmur of its voice reaches these "cloud-capped towers" above it, and indeed at times not even the faintest whisper breaks the solitude. Far away, until lost in the Earth's curvature, arise the summits of these endless mountains, whose succeeding peaks and ranges develop their limitless and silent geometry * before the eye. The fading day rests lingeringly upon them, tinting them in subdued colours, to where, in an indistinguishable haze, the realm of distance and of darkness renders all invisible. The night descends as I watch from where my tent is pitched, the scene is blotted out, and—

> "Like an unsubstantial pageant, faded,
> Leaves not a wrack behind."

The changes of climate are quite marked in one day's journey even in the Peruvian interior; the traveller, as has been seen from the foregoing particulars, may during the early morning be among the inclement climatic conditions of the high "puna," or uplands, whilst the afternoon sun may find him where oranges and lemons grow.

At the general altitude of 10,000 to 13,000 feet a flora very similar to that of the south of England is encountered, and I extract from my note-book—almost illegible from being written on mule-back as I journeyed along slowly, waiting for my lagging muleteers—the following notes: "It would be difficult to find a place more like Devonshire than some of these uplands. Here are the same hills and streams, the same moist, soft, cool atmosphere; the vales of mist and rushing streams of distant Dartmoor, save that these come from eternal snows above. Here are ferns and nettles, fields carpeted with buttercups in bloom, and deep in mossy bank and beneath grey stone walls are violets and stitchwort. I see no well-known furze or gorse, but the hart's-tongue fern is here, and high heads of yellow mustard are in bloom. The little plantations of potatoes might belong to a Devonshire moorland farm, and the dandelions to the border of her country roads. The 'cock's shrill clarion' sounds from the straw-thatched cottages, and cattle are browsing knee-deep in the meadows. But there is snow behind the grey quartzite blocks on either hand, from yesterday's storm upon the Cordillera, and—strange contrast!—clumps of blue lupinus raise their heavy azure heads along the edges of the field, often beneath the shadow of the mountain ash."

But there is little timber; the "quinual" and "quishaar" trees are those which principally predominate, and the eucalyptus, transplanted from Australia, is encountered in many places.

Continuing my journey, I have arrived at the town of Aguamiro, on the river Vizcana, which is a branch of the Marañon, where men and beasts halt for a few days' well-earned rest.

* Mountain ranges seen from above present views of cones intersecting with planes and cylinders.

MOORCROFT AND HEARSEY'S VISIT TO LAKE MANSAROWAR IN 1812.

By Colonel HUGH PEARSE, D.S.O.

THE mission to Lhasa having aroused general interest in Tibet, a short account of the visit to Lake Mansarowar, by way of the Niti pass, made in the year 1812 by the traveller William Moorcroft and his less-known companion, Hyder Hearsey, may be of interest. The names and histories of both men were well known in India in their day, but Moorcroft is now chiefly remembered by the unfortunate termination of his second and last journey, while Hyder Hearsey is unknown, even to geographers, who only mention him to confuse him with his more famous cousin, General Sir John Hearsey.

Hyder Young Hearsey, born in the year 1782, was the son of Captain Harry Hearsey, an English officer in the Maratha service, who fell at the head of his cavalry regiment in the battle of Merta, in 1790. Hyder Hearsey was educated in England, and at an early age followed his father's footsteps, being appointed a cadet in the Maratha service before his seventeenth birthday, and receiving promotion, a few months later, to the rank of ensign, for good service in the field. He was kindly treated by General Perron, the French commander-in-chief of the Maratha army, but, like other Englishmen in that service, soon found his position uncomfortable, and entered the army of the celebrated George Thomas, Raja of Hansi.

In the year 1801, Thomas had become so formidable that Perron decided to crush him, and a sanguinary struggle followed, in which Hyder Hearsey bore an honourable part. When Thomas eventually fell, Hearsey, who remained faithful to him to the end, raised a force of five thousand men in Mewat and established himself as an independent chief. He married Zuhur-ul-Nissa, a princess of Cambay, adopted daughter of the Emperor Akbar II., successor of Shah Alam; he owned large properties, and was in a position of no small importance.

On the breaking out of the war between the British and the Maratha confederation in 1803, Hyder Hearsey at once declared in favour of his countrymen, and was severely wounded in a minor operation in the early part of the war. In accordance with Lord Wellesley's proclamation, calling on all English subjects to assist in the war, Hearsey disbanded his own troops, except one cavalry regiment, which he was permitted to bring in and command. With this regiment, he served in the relief of Delhi and the battle of Deig, and subsequently did good service until the end of the war in 1806.

In 1808 Hearsey accompanied Lieuts. Webb and Raper in an expedition to trace the source of the Ganges, and in the following year he was actively employed in expelling a party of Gurkhas who had taken possession of part of the Oudh Terai. This service was achieved with success, but the incursion of the Gurkhas was one of the aggressions which eventually led to the war with Nepal in 1815. In this war Hyder Hearsey took a prominent part. There is ample evidence in the Parliamentary Papers connected with the war that he was much consulted by Lord Moira's Government; and, in consequence of the ill success which attended our early operations, he and his brother-in-law, William Linnæus Gardiner, who had married another of the princesses of Cambay, were employed to conduct an independent expedition against the province of Kumaon. This operation was eminently successful, but Hyder Hearsey himself was very severely wounded and taken prisoner, his life being saved by the intervention of a Gurkha chief, whose friendship he had made during his expedition to Lake Mansarowar. Hearsey died in 1840.

In the year 1812, Hyder Hearsey, who was living on his property near Bareilly, undertook the exploration of Western Tibet with his friend, William Moorcroft. The latter was a native of Lancashire, who had been educated as a surgeon, but had been persuaded by the celebrated John Hunter to turn his attention to veterinary surgery, a science then much neglected in England. Moorcroft completed his studies in France, and, after making a considerable fortune by the practice of his profession in London, most of which he lost by an unfortunate investment, he accepted an offer from the Court of Directors of the East India Company to go out to Bengal as superintendent of their military stud. He went to India early in the year 1808, and soon formed the conviction that the native breed of horses in India, then of poor quality, could best be improved by an infusion of the blood and bone of the Turkoman horse of central Asia. Mr. Moorcroft, who was a man of many interests, also desired to be instrumental in promoting commerce between India and the neighbouring countries, and he was also desirous of serving his country as a geographer.

To such a man the friendship of Hyder Hearsey was no mean acquisition, and it was undoubtedly thanks to Hearsey's tact, knowledge of native manners and customs, and widespread influence, that the two travellers achieved their remarkable exploration of Western Tibet and returned safely to India.

A summary of Mr. Moorcroft's account of his journey, in company with Hyder Hearsey, to the sacred Lake Mansarowar, is to be found in vol. 12 of that rare publication 'Asiatick Researches,'* published at the *Calcutta Gazette* Office in the year 1816. The summary was made by Mr. H. T. Colebrooke, the President of the Asiatic Society (to use the modern spelling), and certain details of general interest, omitted by Mr. Colebrooke from considerations of space, are still extant in

* The earliest series of *Transactions of the Asiatic Society of Bengal* commenced in 1788.

Hyder Hearsey's notes on his journey, and will be found in the following pages.

Mr. Colebrooke, an acknowledged authority of the period on Indian exploration, states in his introductory remarks that the journey to Tibet was "undertaken from motives of public zeal, to open to Great Britain means of obtaining the materials of the finest woollen fabric. The arduous and perilous enterprise in which Mr. Moorcroft, accompanied by Captain Hearsey, engaged, and which was prosecuted by them with indefatigable perseverance and admirable intrepidity, undismayed by the difficulties of the way and the dangers with which the jealousy of the Nepalese beset them on their return, and undeterred by hardships and privations, and in Mr. Moorcroft's instance by frequent illness, has in the result not only accomplished the primary object which was in view, but has brought an interesting accession of knowledge of a never before explored region; and has ascertained the existence, and approximately determined the situation of Manasarovara, verifying at the same time the fact that it gives origin neither to the Ganges nor to any other of the rivers reputed to flow from it. Mr. Moorcroft . . . found reason to believe that the lake has no outlet. His stay, however, was too short to allow of his making a complete circuit of it: and adverting to the difficulty of conceiving the evaporation of the lake's surface in so cold a climate to be equivalent to the influx of water in the season of thaw from the surrounding mountains, it may be conjectured that, although no river ran from it, nor any outlet appear at the level at which it was seen by Mr. Moorcroft, it may have some drain of its superfluous waters, when more swollen and at its greatest elevation, and may then, perhaps, communicate with Rowan lake, in which the Sutlej takes its source, conformable with the oral information received by our travellers."

Returning to Hyder Hearsey's notes of the journey, we find that the travellers crossed the British frontier of Rohilkhand and entered Kumaon, then occupied by the Gurkhas, on May 9, 1812, disguised as Gosains, or Hindu pilgrims. They were accompanied by no less than fifty-two natives — mostly hill coolies, no doubt, but including an Afghan soldier of fortune named Gholam Hyder Khan,* who had long been attached to Hyder Hearsey, and two pundits, or educated natives, who had been engaged as surveyors.

Moorcroft states that Hearsey undertook the survey of the entire route traversed, and that Harkh Dev, one of the pundits, paced the road; two of his ordinary steps measuring exactly 4 feet.

From May 9 to 24 the travellers went over ground that had already been explored by Colonel Colebrook; but on the latter date they left

* Gholam Hyder Khan afterwards accompanied Moorcroft on his ill-fated expedition to Bokhara, and was the only member of it who returned to India.

the Badrinath road at Joshimath, and thence travelled over unexplored ground to the village of Niti, which they reached on June 4. At this point the Tibetan authorities began to make difficulties about further progress, pointing out "that this was a road by which pilgrims to Mansarowar seldom came; that we were armed; that we had many people; that report said that we were either Gorkhalis or Firingis come with designs inimical to the Undes; and that measures had been taken accordingly." (Undes, or Hundes, was the name applied to Tibet by the travellers.) The disguise as Gosains had, then, not been altogether successful, as might have been anticipated; and nothing but the great tact, patience, and courage shown by the travellers enabled them to complete their journey to the sacred lake. The Tibetans have from time immemorial shown the greatest aversion to any visits by Europeans from India, while the hill states of Kumaon and Garwhal were at this time in the hands of the Nepalese, whose policy was most hostile to the English. The Gurkha war, which broke out two years later, was in fact already brewing. Moorcroft and Hearsey explained to the headman of Niti that "for pious and humane reasons we wished to visit the Lake of Mansarowar; that for defraying our expenses we had brought certain articles from our country for sale; that we had for our own defence certain arms which we were willing to leave in his keeping during our stay in the Undes."

This declaration seemed to give satisfaction, but the travellers were requested to await for a period of fifteen days, until the reply of the Tibetan rulers of that province could be received.

After many days of fruitless and wearisome negotiations, it at length became clear that the delay was entirely caused by the headmen of the Niti villages themselves, the authorities on the Tibetan side of the pass having no means of stopping the travellers if the Niti headmen chose to introduce them to their northern neighbours. The sacrifice of a bottle of brandy, made into punch and well sweetened, was not without effect in a heated debate which took place on June 23; but the ascent of the pass did not finally take place until the last day of the month.

Travelling slowly and gradually establishing friendly relations with the chiefs and priests of the province, Moorcroft and Hearsey reached the town of Daba (some 20 miles over the border) on July 3. They had experienced considerable difficulty in traversing the Niti pass, the road being of the roughest description.

They describe Daba as "perched upon the top of a rock which juts out towards the river with an irregular declivity, and is surmounted by the highest eminence in the whole line which defends it from the north-west." They add that at Daba they found a few cultivated fields, which were the first that they had found in Tibet. The river referred to is the Tiltil, a tributary of the Sutlej.

There were three persons of importance at Daba, styled by Moorcroft the Lama, the Wazir, and the Deba, or head zemindar.* The wazir was absent on business towards Mansarowar, and his son represented him. Hyder Hearsey's notes, which are more plain spoken than Mr. Moorcroft's narrative, run as follows :—

"After breakfast this day (July 4) Umar Singh sent word to us to come and pay our respects to the wazir's son, in council assembled with the lama and the son of the deba. We proceeded about nine o'clock attended by the pundit and three or four other servants, carrying the presents for these people. The presents consisted of 3 yards of superfine scarlet broadcloth, some sugar and spice, all arranged on a brass plate. We first entered a gate, over against which was fastened a very large and handsome dog, something of the Newfoundland breed; the entrance stunk very much of him.

"We then had to stoop to enter another door—filthy enough, stench abominable. We then proceeded up a few steps of earth and stones, all broken. We turned to the right and entered a small antechamber, to the right of which was the women's room. A greasy, filthy purdah was then lifted up, and we entered the parlour. Here we found a clean mirzai, or poor woollen carpet, spread for us in the centre of the room. In front was a vacant seat, opposite to which our presents were placed. On the right sat the lama on a cushion; before him was placed a kind of tea-poy (three-legged table), on which were two wooden varnished plates, painted and gilt. There was also a fire-pan. The old gentleman appeared about seventy years old, had a shrewd countenance, said very little, and eyed us all the time. He was dressed in a coarse, woollen, red garment, the manufacture of the country, greasy and dirty in the extreme. This was the bishop of this see.

"He had another priest sitting to his right, more black, more filthy, and more ugly than himself. Opposite to me sat the son of the deba, a dark but sensible, though rather heavy-looking person, aged about twenty-nine or thirty. He had a paper in his hand at our entrance, as if in the act of writing. He was seated on a leather cushion stuffed with wool, over which was a carpet; before him was a sort of small table, on which were two of the wooden plates before mentioned, a china cup, an inkstand, a wooden pen, and a knife. To his right lay a long silver pipe. He was dressed in a red, blue, green, and yellow striped woollen gown."

It appeared that the paper was a letter to the commander of Gortope (or Gartok), a neighbouring seat of government, explaining that Moorcroft and Hearsey really were harmless pilgrims, and not the dreaded Firingis, and requesting that they might be permitted to

* It appears that the terms "wazir" and "deba" were incorrectly used, the former not being a Tibetan word, while *deba* is merely a respectful suffix.

proceed to Lake Mansarowar. Suspicions were again aroused on the following day by the discovery that Hearsey wore half-boots of an English pattern, a curious slip on his part, which his fellow-traveller records with obvious relish, adding that he himself had taken the precaution of having turned-up toes added to his own shoes.

On July 8 an answer to the deba's letter was received from Gortope, which was conveyed to the travellers on the following day. It was to the effect that the governor had been informed three years previously that some Europeans were about to come into the country. He therefore desired to see the travellers.

Messrs. Moorcroft and Hearsey accordingly set out from Daba on July 12, and, after a six days' march, reached Gortope, which they found to be a large encampment of blanket tents in clusters. The deba, however, had a small house, surrounded by a fence about 4 feet high, and to this residence the travellers were at once summoned. The interview was a long one, and the council, similarly composed to that at Daba, was at first distrustful, but the travellers were at length enabled to allay all suspicion as to their being Europeans.

On the following day, July 18, trade relations were established, and the Kashmirian vakil, or agent, of the Raja of Ladak, who was at Gortope, expressed a desire to open a commerce with Hindustan.

By July 22 Mr. Moorcroft was on friendly terms with the "deba," who, when asked what articles he would like brought up for him from India, said that "a sword and a necklace of large pearls of a rose-colour, pear-shape, and free from flaws or irregularities, would be most acceptable." Evidently an enlightened man, the deba, and a shrewd man of business too, for Mr. Moorcroft adds that he gave a sketch of the necklace which he desired, worth probably about two thousand rupees, but the cost of which the deba estimated at three or four hundred. The deba then gave the travellers leave to visit Mansarowar, but ordered them to confine themselves strictly to the usual pilgrim road, and to return by the Niti pass.

It is worth mentioning that Hearsey was informed by the vakil of the Raja of Ladak that the *Ooroos*, or Russians, had long been in the habit of trading with that country, and had, in the last three years, pushed a lively trade into Kashmir by means of agents. The *Ooroos* had not yet visited Ladak in person, but the Deba of Daba asserted that caravans of five or six hundred of them, on horseback, had come to the fair of Gortope. In a later conversation the Ladak vakil said that a few Russians had been in Kashmir.

The travellers left Gortope on July 23, and on August 2 arrived at "the Lake of Rawanhrad, a large sheet of remarkably blue water, said . . . to communicate by a river with the lake Mansarowar." On August 5 they came in view of the holy lake, and on the following day halted on its bank. The travellers remained for two days, exploring the shores of the lake. Mr. Moorcroft describes Mansarowar in the following terms: "In form it appeared to me oblong, the sides of the east, west, and south nearly straight; that of the north, and especially to the north-east, where there is a plain at the foot of elevated land, indented and irregularly tending to the east. The angles were not sharp, or its figure would have approached nearer to a square than to any other, but it may be considered as an irregular oval. Its breadth from south to north I estimate at about 11 miles, its length about 15. The water, except where disturbed by the wind near the beach, where it is sandy, is clear and well tasted. No weeds are observable on its surface, but grass is thrown upon its banks from the bottom. The middle and sides farthest from the spectator reflect green, and, taken altogether, it has a noble appearance, whether in an agitated or a quiet state." Mr. Moorcroft discovered a number of caves, inhabited by religious recluses, and mentions that one of the nuns, struck by pity, no doubt, at his haggard and worn appearance, offered him hospitality, but "with the most cordial salutation and expression of thanks by dumb show," he took his leave and went on with his survey. Mr. Hearsey, meanwhile, cut Moorcroft's name and his own on a stone, and left it in a secure place, an excusable act under the circumstances.

The return journey was begun on August 8, and on the 22nd the party again reached Daba, where the children received them as old friends. The travellers had some difficulty in obtaining transport to carry them back over the mountains, but eventually left Daba on August 26, and by September 3, after an arduous journey, were delighted to see trees once again. Their worst troubles were, however, to come, for after an interesting march through the hill country, during which they resumed their European dress, the travellers were arrested by the Gurkha rulers of Kumaon.

On October 9, Banda Thapa, a chief who had communicated by letter with the travellers four days previously, met them by appointment at Chandpur. Banda Thapa, "a stout old man of seventy, and altogether not superior in his appearance to one of the zemindars of Ghazipur," * inquired why Messrs. Moorcroft and Hearsey were travelling through Gurkha territory, and particularly why they had disguised themselves. The travellers replied that it was the custom for travellers to disguise themselves, and that by no other means could they have entered Tibet. They asked if any complaint had been made as to their conduct, and, on receiving satisfactory assurance on that head, pointed out that hundreds of Nepalese were allowed to travel at their pleasure through the Company's territories.

Banda Thapa took his leave, apparently satisfied, but on October 15

* Moorcroft's residence in India.

the travellers were finally arrested, and placed under a military guard. They were informed that the local authorities were in consultation as to what should be done with them, and it transpired later that their arrest was in fact ordered by letter from Khatmandu, the Nepalese capital. Mr. Moorcroft, who was armed at the moment of arrest, was treated with great violence, and his arms were pinioned. Hearsey was held by several men, but not bound. The pundits and other followers of the party were shackled to wooden blocks. Mr. Moorcroft acted with great courage and firmness, and after a time secured his own release and that of his servants.

Hyder Hearsey writes with great indignation of the manner in which he and Mr. Moorcroft were treated, but as the Gurkhas had been ordered by their rulers to arrest the party, who obviously declined to stop when requested to do so, it is hard to see how violence could have been altogether avoided. After various communications with Bam Sah, the Gurkha governor of the Almora district, and Amar Singh, the commander-in-chief of the Gurkha army, Moorcroft and Hearsey were released on November 1. The Pundits, however, still remained in irons until November 5, when a letter arrived from the Maharaja of Nepal, directing that the whole party should be set at liberty and escorted into British territory.

So ended this adventurous journey, the first occasion on which English travellers from India traversed the Himalaya mountains into Western Tibet, and visited the sacred lake of Mansarowar, the great plain between the Himalayas and the Kuen-lun mountains, and the upper waters of the river Sutlej.

NOTES ON A JOURNEY THROUGH THE NORTHERN PENINSULA OF NEWFOUNDLAND.

By H. C. THOMSON.

In spite of the fact that the railway now goes right across Newfoundland, the interior is still comparatively little known, more especially that portion of it extending from Bonne bay to Cape Norman, forming part of the French shore, and commonly known as Le Petit Nord. Before long it will be traversed from end to end in the search for the mineral wealth it is believed to contain, for the country itself is an easy one to travel in. Last summer a friend, Mr. W. H. Burt, and myself spent six weeks in wandering through it, and these notes may be of assistance to those who wish to undertake a similar journey.

Sir Robert Bond, the Premier, very kindly gave us letters of introduction to different people along the coast, and also to Mr. J. P. Howley, F.G.S., the Director of the Geological Survey, who knows more of the interior than any one in Newfoundland. To him we are indebted for much kindness, and for a great deal of invaluable information.

By the advice of Mr. Howley, we arranged with Matthieu Michel, a Mic-mac trapper, more generally called Mattie Mitchell, the only man who has ever made a connected journey from one end of the northern peninsula to the other, to go with us as guide. He took with him his son, a boy of sixteen, and Reuben Smith, another reliable Bonne bay guide.

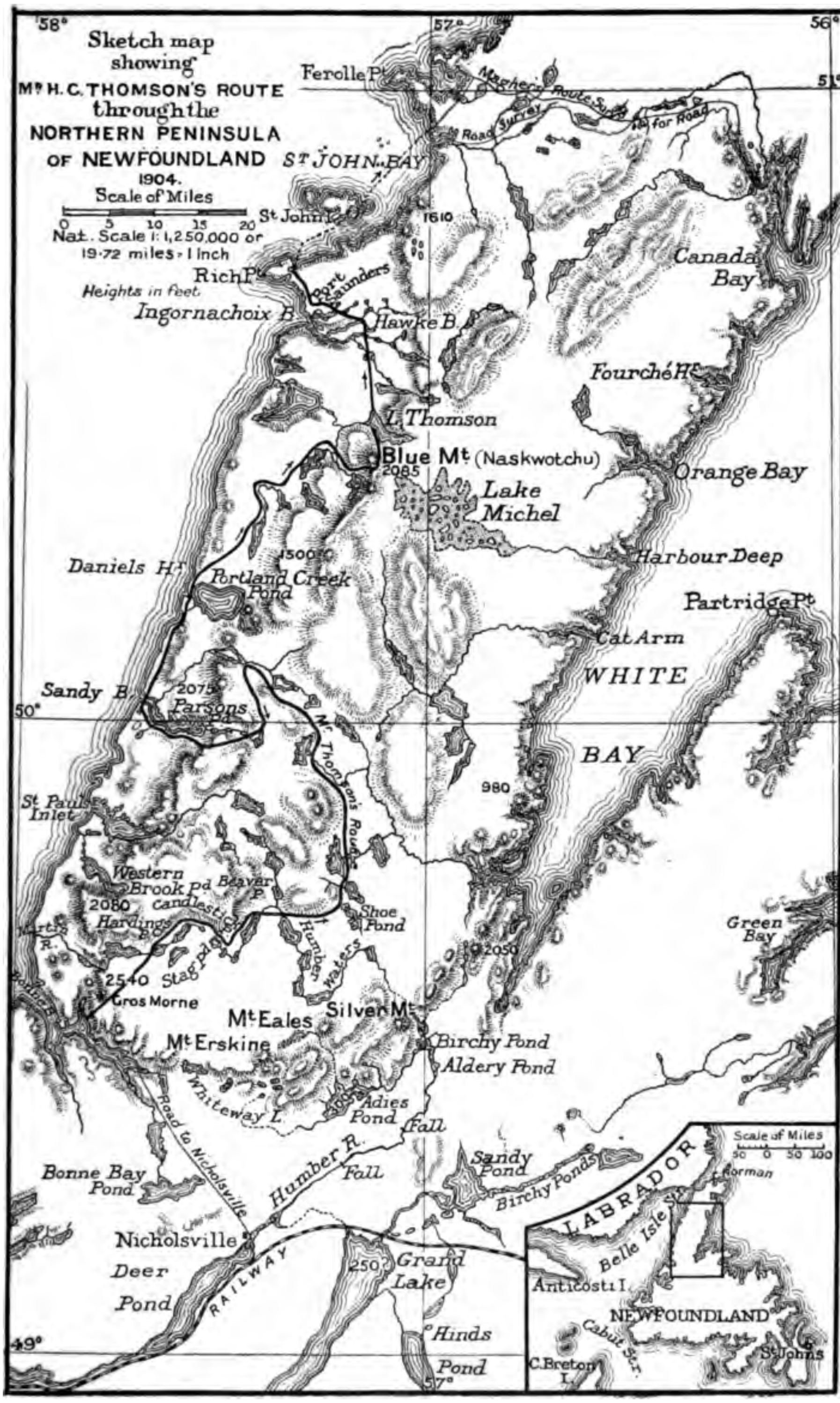
Everything had to be carried on our own backs; so we took nothing that was not absolutely needful, every pound being a matter of consequence. We left Bonne bay on August 29, and ascended to the high plateau that lies to the north of the bay by a landslide, or "scrape," to use the local expression, of over 1000 feet in height, of exceedingly slippery blue slate, on which it was difficult to obtain a foothold.

The weather was clear and warm. The summer had been an exceptionally hot one, many days over 90° in the shade, and although the approach of autumn was already beginning to make itself felt, the lowlands were carpeted with flowers and with a profusion of berries.

On August 31 we crossed the watershed. We could see south as far as the Topsails, the hills over which the railway passes on its way to the Grand pond; whilst to the north-east there lay before us a long succession of small lakes, or ponds, as they are called in Newfoundland. The first of these the men knew as the Stag pond. Its sides were covered with the blue flag, and with a species of lily called the beaver root, constituting the chief food of the beaver, which the Indians say is good for consumption. Michel told us that in the Stag pond one of the branches of the Humber rises.

On September 1 and 2 our course took us over broken ground, ridge after ridge of low hills, with intervening lakes. Up to this point we had met with nothing but hard granite and syenite, with no sign of mineral in it.

On September 3 we crossed the Humber, the northern branch of the river. In the old maps it is depicted flowing in an almost straight line from a big lake at the back of Doctor's Hill, a considerable way to the north of Hawke's bay. The existence of this lake was based mainly on conjecture, and in the more recent maps it was left out altogether, the source of the Humber being taken to be Adie's pond. Prof. Jukes, writing in 1840, mentions, however, that the Indians said that "the Humber flows from two large ponds on the eastern flank of the long range, about in the latitude, or as they expressed it, at the back of Cow's Head." This, Michel said, was actually the case, that there are really three sources—one in Adie's pond; one in Stag pond, where we had already met with it; and the one we were then crossing, which rises in a pond at the back of Cow's Head. There is, as a matter of fact, a large lake in the interior, which Michel had once visited, but it



Sketch map
showing
Mr H. C. THOMSON'S ROUTE
through the
NORTHERN PENINSULA
OF NEWFOUNDLAND
1904.
Scale of Miles
0 5 10 15 20
Nat. Scale 1:1,250,000 or
19·72 miles = 1 inch
Heights in feet
58°
57°
56°
51°
50°
49°
Ferolle Pt
St JOHN BAY
St John I.
1610
Rich Pt
Port Saunders
Ingornachoix B.
Hawke B.
Canada Bay
Fourché Hr
L. Thomson
Blue Mt (Naskwotchu)
2085
Lake Michel
Orange Bay
Harbour Deep
Daniels Hr
1500
Portland Creek Pond
Partridge Pt
Cat Arm
WHITE
BAY
Sandy B.
2075
Parsons
Mr Thomson's Route
980
St Pauls Inlet
Western Brook Pd
Beaver P.
Candlestick
2080
Hardings P.
Shoe Pond
Humber Waters
2050
Green Bay
2540
Stag Pd
Gros Morne
Mt Eales
Silver Mt
Mt Erskine
Birchy Pond
Aldery Pond
Whiteway L.
Adies Pond
Fall
Road to Nicholsville
Humber R.
Fall
Sandy Pond
Birchy Ponds
Bonne Bay Pond
Nicholsville
RAILWAY
Deer Pond
250
Grand Lake
Hinds Pond
Scale of Miles
50 0 50 100
LABRADOR
Belle Isle
Anticosti I.
NEWFOUNDLAND
Cabot Str.
C. Breton I.
St Johns

lies a good deal to the south of where it was placed on the old maps, and is where I have placed it on the accompanying map. The Humber is not connected with it in any way, but it drains into either Cat Arm or Harbour Deep; Michel is not sure which, but he thinks into Harbour Deep. He canoed all round it, and called it the Lake of Three Hundred Islands, from the immense number of small islands with which it is studded. He calculated that it is rather over 20 miles in length, and from 10 to 15 miles in width. Our march after this took us over thickly wooded hills to the Sop's Arm river, the wood being almost entirely fir, rather stunted, with hardly any spruce or birch. Very few

LAKE ON THE WEST SIDE OF THE BLUE MOUNTAIN.

of the lakes of this high plateau contain fish; either the water is too cold, or the streams issuing from them have high falls up which the salmon are not able to pass.

On September 4 we altered our course for Parson's pond, not having time to go on to the Sop's Arm Steady, as we intended. The morning was misty, we could hardly see 20 yards ahead of us, and the walking was difficult, the toil of forcing a way through the thick undergrowth being very great. We rose gradually to a broad, fairly even barren, with here and there a curious saddle-backed outcrop of granite, generally from about 100 to 200 feet in length and 50 feet in width at the base, terminating at the top in a sharp ridge—a curious formation for which we were unable to account. There was evidently much iron about, for the compasses swung a good deal.

On September 5 our course took us over a rocky, moss-covered barren, fairly dry, and with comparatively little bog, and about mid-day we came to the end of the gorge which lies at the back of the upper Parson's pond. It is a deep-cleft ravine with cliffs nearly 2000 feet in height, rising almost sheer, and approaching to within a few hundred yards of each other. Between them winds a long sinuous lake which entirely fills up the gorge, so that the only way through it would be by making a raft. Beyond the lake we could see a low strip of green marshland, and beyond that the azure sea. The atmosphere was of that extraordinary clearness which one so often finds in mountains after rain. The hills were cleft by ravines at short intervals, forming flat-topped

LONG RANGE AT THE BACK OF PARSON'S POND.

barrens with abrupt sides, giving them, from the sea, the appearance of gigantic barns; that, doubtless, as Archbishop Howley pointed out to me, being the origin of the French name "La Grange" of this mountain chain, of which the English "Long Range" is probably a corruption.

The sides of the gorge were too steep to be attempted with our heavy loads, and the timber, seen through our glasses, looked too small to make a raft with of sufficient strength to risk ourselves upon it on the lake, as the wind blows like a hurricane through these funnel-shaped openings between the hills. There was nothing for it but to hark back along the crest of the Long Range to try and find an easier descent.

On the 6th, after a stiff climb up and down rocky ridges, we came on a small ring-shaped pond into which a good-sized brook flowed, but to which there was no apparent outlet. High cliffs on both sides rose almost perpendicularly, and at the other end of the pond we came on a narrow valley shut in by hills on three sides. We clambered down by a dry rocky watercourse, and after a couple of hundred feet of descent came upon a fairly large stream issuing by an underground outlet from the lake above. We found here a few traces of copper and a little pyrrhotite. In the wood at the bottom of the valley the flies, which had not troubled us at all on the uplands, were exceedingly bad, both black flies and mosquitoes. In places the scrub was so thick that we had to cut our way through it with the axes, and finally had to wade down the stream in icy cold water for a couple of miles to a chain of little lakes with a strip of level land between them and the hills, covered with a thick growth of stunted spruce and juniper—"tucking bushes" as they are called in Newfoundland—which, in our tired state, proved more difficult to walk upon than anything we had yet experienced. The branches interlace like a creeper, but are not strong enough to bear a man's weight, and the labour of wading through them, encumbered with a heavy load, is extreme.

On the 7th we came to bigger timber, spruce and birch intermingled with the fir, and a rapid descent by a trapper's path brought us out on the extreme end of Parson's pond, on a soft piece of swampy ground. We edged along the pond to the camp of the Newfoundland Petroleum Company, where Mr. Powell, the manager, kindly put us up. The company has three boreholes on different sides of the pond, each over 2000 feet in depth. The oil is of good quality, but as yet the supply is scanty. The rocks here are stratified rocks, mostly sandstones and limestones, belonging to one of the older geological formations.

On September 8 an exceedingly trying march over boggy ground, into which we sank over our knees in the soft spongy moss, making walking excessively laborious, took us out to Sandy bay at the mouth of the river, where we put up in a comfortable little fisherman's boarding-house. Unfortunately, there were no sealskin boots to be had, nor were we able to get any until we arrived in Port Saunders. They are quite indispensable for a journey of this kind.

From Sandy bay we followed the Government road along the seashore as far as the Portland Creek river, where we camped. A French sailor, Alain Ofry, who has settled here, said the soil in places was excellent, as good as any he had seen in his native Brittany. Potatoes, cabbages, and turnips all do well. He has a large garden, eleven sheep, and several cows. There is plenty of pasturage for the cattle, and an abundance of hay. The soil, it is true, is boggy, but there is a strip, which he took me to see, running along the coast from half a mile to a mile in width, which consists of a dry peaty soil with a clay subsoil of altogether about 5 feet in depth, on which he said almost anything

STAG POND.

would grow. He told us he had no trouble whatever with the sheep, except from the dogs. He only had a few, but he thought there would be no difficulty in keeping any quantity that might be desired.

The general view in St. Johns is that the country is quite impracticable for sheep, the ground being too wet and barren; but, so far as I was able to learn, both liver-fluke and foot-rot are unknown, and the few sheep that are now kept along the west coast, which is by far the most promising side of the island for sheep, do well, and have no difficulty in getting through the winter, and the exposure makes them grow a remarkably fine and full fleece, the wool fetching a high price. Whether sheep-raising could ever be rendered profitable on a large scale can, however, only be demonstrated by one or two attempts made by practical sheep-farmers with a sufficiently large capital to ensure a fair trial. If it could be, the market both in Great Britain and in America would be a near and a lucrative one.

It is curious that the original settlers took a much more hopeful view of the question than the present generation of Newfoundlanders, whose attention is devoted almost entirely to the fisheries. Captain Hayes, whom I will again quote, said, "the grasse and herbe doth fat sheepe in very short space, proved by English merchants, which have carried sheep thither for fresh victuall, and had them raised exceeding fat in less than three weekes."

There most certainly is no want of pools, and the constant rain and the great extent of bog land have given rise to the opinion that sheep could not possibly thrive. At the present time there are not 100,000 in the whole island (at the last census there were 78,000), although it is a third larger than Ireland. But in Finland, in which the proportion of water and swamp is even greater, comprising 32 per cent. of the whole, and where the rock formation is of a very similar nature, the number of sheep—according to the *Times* Encyclopædia—at the last census was found to be no less than 1,092,420, whilst in Norway there were 1,417,500, and in Sweden 1,261,493.

On September 12, from Portland creek we went 4 miles further along the coast to Daniel's harbour, and thence made our way again inland over the same kind of country, marshes and lakes in the low ground (which is there of much greater extent) lying between the hills and the sea. In places we came upon fairly good timber, and immediately under the hills we found a series of long and deep lakes, one of which we had to cross by means of a raft. On the other side we found ourselves immediately beneath the Blue mountain, the Mic-mac name for which, Michel told us, is Naskwotchu, or Blue hill.

NORTHERN BRANCH OF HUMBER RIVER.

Our course took us right across it, but unfortunately the day was wet and misty, and we could see but little of the surrounding country, though Michel pointed out the position of the great island-covered lake which he had once visited, and to which his name has since been given by Mr. Howley. In the glimpses of sunshine we could see almost as far as Canada bay, following the north-easterly trend of the Long range, the granitic backbone of the peninsula.

On the other side of the mountain we travelled through some remarkably fine timber to another and even larger lake, where we again had to build a raft. It took us a day and a half to get round to the other side, as there was a nasty lop on the lake which sent the

GORGE AT BACK OF PARSON'S POND.

water right over the raft and delayed us considerably. I should mention that the honour of giving my name to this lake has been conferred on me. From the other side we made our way to Hawke's bay through fairly level and heavily timbered land.

It took us altogether ten days of hard marching to get from Daniel's harbour to Hawke's bay, and for the last four days we only had half a pound of flour a day each, with tea and a little sugar.

The unbroken silence was profoundly impressive, with the absence both of animal and of bird life. There were, no doubt, great numbers of caribou, for we saw their tracks everywhere; but we never heard them and hardly ever saw them. Prof. Jukes had a similar experience, "Notwithstanding," he says, "the abundance of deer in many places I visited, I was never lucky enough to see one alive, nor have I seen more than one recently killed." Michel said the deer were, if anything, increasing in number. Nor did we come across any bears, which are still common in some parts of the island. Beavers are practically extinct, and so are wolves, whose place has been taken of late years by the lynx, which is said to have made its way over from Labrador, for it was formerly unknown. As yet the wolverine, or carcajou, so much dreaded by the Indians in Labrador, has not made its appearance. The Canadian hare, which in Newfoundland is called the rabbit, was very scarce, a disease having almost exterminated it during the preceding two years. Bird life also was scanty: we saw no curlew, which are said to have been formerly so plentiful; only a few snipe and twillick, and here and there a few ptarmigan and willow grouse, and an occasional duck, or fish-hawk or loon. The only exception was the ubiquitous jay, the *Corvus Canadensis*, two or three of them never failing to visit our camp in quest of food; and at night we used sometimes to hear the hooting of an owl. The absence of reptile life was even more remarkable; not a snake, or lizard, or frog, or toad. None had ever been seen in the island, until some frogs were imported by a Canadian enthusiast and turned loose near St. John's a year or two ago.

From Hawke's bay it was a day's march to Port Saunders, where we were at last able to get sealskin boots, the want of which had made the last few days exceedingly trying. As it was, we were able to complete our journey to Flower's cove on the Straits of Belle Isle in comparative comfort. From Hawke's bay the land slopes gradually down, until in the extreme north it becomes flat and low, not more than 100 feet above the sea-level, and the formation changes from granite and quartzite to a compact cherty limestone with an almost horizontal stratification.

At Port-au-Choix we were kindly received by Captain Laurent, who put us up, and sent us across the following day in one of his schooners to Bartlett's harbour, on the other side of St. John's bay, thereby saving us a troublesome march of about 30 miles. The obstacle of the French treaty rights, which stood in the way for so long of the development of this coast, has now been happily settled by the Anglo-French Convention, and there is no reason why the French shore should not now be profitably worked, as regards both mines and agriculture, as well as the fisheries, if it be found that such development is practicable.

And although the climate is a hard one—the winter long, and the summer all too short, there is no reason to despair of the success of agriculture even in the northern peninsula, which the Arctic current, setting through the Straits of Belle Isle, has rendered less fit for cultivation than the rest of the island. The conditions are not worse there than in Finland and Lapland, where the majority of the population depend mainly upon the land, and not upon the fisheries, and where, although wheat cannot be raised any more than it can in the greater part of Newfoundland, they nevertheless make a subsistence from oats and rye, potatoes and beetroot, all of which do admirably in Newfoundland, although hardly any of the fishermen take the trouble to grow them.

At Flower's cove we took the steamer back to Bonne bay, and from there walked over to the railway at Deer lake, which we reached on October 15, thus ending an enjoyable and interesting journey. On

LAKE ON EASTERN SIDE OF THE BLUE MOUNTAIN.

arriving at St. John, I handed the rough sketch-maps of our course, which I had made with the assistance of Michel, to Mr. Howley, who very kindly reduced them to scale, and laid them down on an Admiralty chart of the northern peninsula. On returning them to me, he wrote, "While, of course, it cannot lay claim to any such accuracy as an actual instrumental survey, it nevertheless affords sufficient evidence of approximate reality as to warrant my inserting it (provisionally) on our general map of the island.

"I have little doubt that the main topographical features, as depicted by you with the assistance of your Mic-mac guide, Mattie Michel, are correct. I know these Indians well enough to be aware of their acute powers of observation, of which I have frequently availed myself in mapping out portions of the interior."

The Mic-macs came over from Cape Breton in 1782, after the war with America, when they were given a grant of land in Bay St. George. They are nearly all gone now, Michel being one of the few remaining. A fierce feud existed between them and the Beothuks, the aborigines, for whose extermination they were even more responsible than the settlers—an extermination that is to be in every way regretted. They would have been invaluable in the development of the island, for the early colonists speak of them as friendly and tractable, quick in apprehension, and of an ingenious and subtle disposition; and the interior, instead of being the desolate wilderness it now is, might have been filled with flocks and herds. With their knowledge of woodcraft, they might, and probably would, have taken in Newfoundland the place of the Forest Laps in Lapland.

DIMENSIONS OF THE NILE AND ITS BASIN.

By Captain H. G. LYONS.

The length of the Nile is usually given * as 5400 kilometres (3355 stat. miles) to the centre of Lake Victoria, or 6000 kilometres (3728 stat. miles) for the continuous waterway from the source of the Kagera to the sea; the area of its basin is given as about 2,900,000 square kilometres (1,119,737 square miles). These measurements have hitherto been made on small-scale maps, but since a considerable part of the upper Nile has been recently surveyed on 1 : 250,000 or a larger scale, and numerous points in its course have been fixed astronomically and by triangulation, it is now possible to measure its length sufficiently accurately to furnish a value which later surveys probably will not materially alter.

In the opposite table the results of such a measurement are set forth together with the maps used. The measurements were made with the curvimeter,† and the mean of four concordant readings were taken. The centre line of the river was followed as far as possible, and round islands the wider arm. The measurements were made in kilometres, and were corrected for instrumental errors and map shrinkage.

The distances below Wadi Halfa are those generally accepted.‡ A new triangulation has just been completed from Damietta to Wadi Halfa, and the publication of a general map of the Nile valley and delta on the scale of 1 : 50,000, based on the Revenue Survey maps of 1 : 2500 and 1 : 4000, will be commenced forthwith; as soon as these map sheets are ready, improved values for this distance will be

* Wagner, 'Lehrbuch der Geographie,' p. 417. Hanover: 1903.

† By Coradi, of Zürich.

‡ Willcocks, 'The Nile in 1904,' Tables vii., viii. London: 1905.

TABLE OF DISTANCES ON THE RIVER NILE.

	Place.	Distance. Km.	Distance. Miles.	From Ripon falls. Km.	From Ripon falls. Miles.	Authority.	Scale.
Victoria Nile.	Ripon falls	—	—	—	—	Intell. Dept. W.O., Map No. 1429.	$\frac{1}{633600}$
	Kakoji	64	40	64	40		
	Mruli	135	84	199	124	Survey by Captain R. Owen. Cf. *Geogr. Jour.*, March, 1905.	$\frac{1}{190080}$
	Foweira	75	47	274	170		
	Murchison falls ...	77	48	351	218		
	Albert lake	38	24	389	242	Colonel Delmé-Radcliffe, *Geographical Journal*, Feb. 1903.	$\frac{1}{500000}$
Bahr el Jebel.	Bahr el Jebel entrance	3	2	392	244		
	Wadelai	64	40	456	283		
	Nimule	152	94	608	378		
	Asua river	21	13	629	391	Sir W. Garstin, 1903.	$\frac{1}{1000000}$
	Fort Berkeley ...	126	78	755	469		
	Gondokoro	32	20	787	489		
	Lado	12	7	799	496	Captain H. G. Lyons, 1901 and 1903, adjusted to positions determined by Colonel Hon. M. G. Talbot, R.E.	$\frac{1}{80000}$
	Mongalla	29	18	828	515		
	Bor	134	83	962	598		
	Kenisa	117	73	1079	670		
	Ghaba Shambé ...	80	50	1159	720		
	Hellet Nuer	181	112	1340	833		
White Nile.	Lake No	208	129	1548	962		
	Taufikia	132	82	1680	1044		
	Dueim	630	391	2310	1435		
	Khartum	200	124	2510	1560		
Nile.	Shendi	186	116	2696	1675		
	Atbara river	139	86	2835	1762	Topographical Division, General Staff. Map of Africa.	$\frac{1}{250000}$
	Berber	40	25	2875	1786		
	Abu Hamed	208	129	3083	1916		
	Merowe	240	149	3323	2065		
	Dongola	272	169	3595	2234		
	Wadi Halfa	445	277	4040	2510		
	Aswan	345	214	4385	2725		
	Luxor	219	136	4604	2861		
	Qena	64	40	4668	2901		
	Girga	124	77	4792	2978		
	Assiut	141	88	4933	3065		
	Cairo	397	247	5330	3312		
	Delta Barrage ...	23	14	5353	3326		
	Rosetta mouth ...	236	147	5589	3473	Total length, 5589 kilometres or 3473 miles.	

SOURCES OF KAGERA RIVER TO RIPON FALLS.

Place.	Distance. Km.	Distance. Miles.	From source. Km.	From source. Miles.	
Source	—	—	—	—	
Kagera mouth ...	590	367	590	367*	Karte von Deutsch Ost-Afrika. Reimer, 1895. 1 : 300,000
Ripon falls ...	218	135	808	592	Chart of Lake Victoria, by Com. B. Whitehouse, 1900-1.

Length of continuous waterway, 5589 + 808 = 6397 kilometres or 3975 miles.

obtainable, but it is not anticipated that those given above will be much altered.

The area of the Nile basin is given by Bludau † as 2,803,000 square

* As shown by Dr. Kandt, the length of the Kagera will be somewhat greater.—[ED. *G. J.*]

† *Pet. Mitt.*, 1897, p. 184.

kilometres (1,082,284 square miles), composed of 2,660,000 square kilometres (1,027,069 square miles), representing the area known to drain to the Nile, and 143,000 square kilometres (55,215 square miles) to the west of Lake Rudolf and south of the Sobat river, which was then unexplored. Taking this as the most recent value, it may be compared with a more complete estimate, which the recently published maps of the Sudan permit.

For determining the area of the catchment basin, the larger-scale maps which were used in measuring the length of the river are not necessary, for over almost all the basin there is a very small amount of topographical detail, so that the watershed between the different river-basins can only be approximately indicated. The area has therefore been calculated from a map on the scale 1 : 4,000,000 * for the Sudan and Uganda, and from one of 1 : 2,000,000 † for Egypt. The proportion of each square degree belonging to each basin was determined by measurement on the maps, and the area in square kilometres deduced from it. The results are given in the following table :—

AREAS OF CATCHMENT BASINS.

Name of basin.	Area in square kilometres.	Area in square miles.
Victoria lake	238,900	92,243
West valley ‡	54,100	20,889
Victoria Nile	75,600	29,190
Bahr el Jebel §	190,700	73,632
Bahr el Ghazal	552,100	213,175
Sobat river	244,900	94,560
White Nile	353,500	136,492
Blue Nile	331,500	127,998
Atbara	220,700	85,216
Nile	605,600	233,832
Nile basin	2,867,600	1,107,227

The area of the basin will vary according to the distance to which its limits are considered to extend on the west of the Nile northwards of Khartum. It has here been taken as far as the cliff of the desert plateau, or the first marked rise of the desert where the cliff is absent, probably, on the average, about 3 to 4 kilometres (2 to 2½ miles) from the edge of the cultivation. The whole of the Nile basin below Khartum, and practically all the White Nile basin, are non-effective in increasing the river-supply, since the occasional local cloud-bursts may

* I.D.W.O. Map, No. 1856, extended southwards to include the Victoria lake and its catchment basin.

† Topog. Div. Gen. Staff, 1905.

‡ Including the basins of Albert Edward and Albert lakes, and the Semliki river.

§ Including the Bahr el Zaraf.

be neglected. The Bahr el Ghazal, as has been shown by recent measurements of the volume discharged, is also practically non-effective.

All measurements have been made in the metric system, and the "rounded off" values converted to miles and square miles.

THE BAROTSE BOUNDARY AWARD.

By the award of the King of Italy, given in June of the present year, one of the last outstanding boundary questions between European powers in Africa, which has been awaiting solution now some fifteen years, has at last reached a settlement; and though the result has been to give this country a much smaller portion of the territory in question than had been claimed by those responsible for the preparation of the British case, it is, no doubt, well that the uncertainty which has so long prevailed as to the ultimate destination of the territory should once for all have been removed.

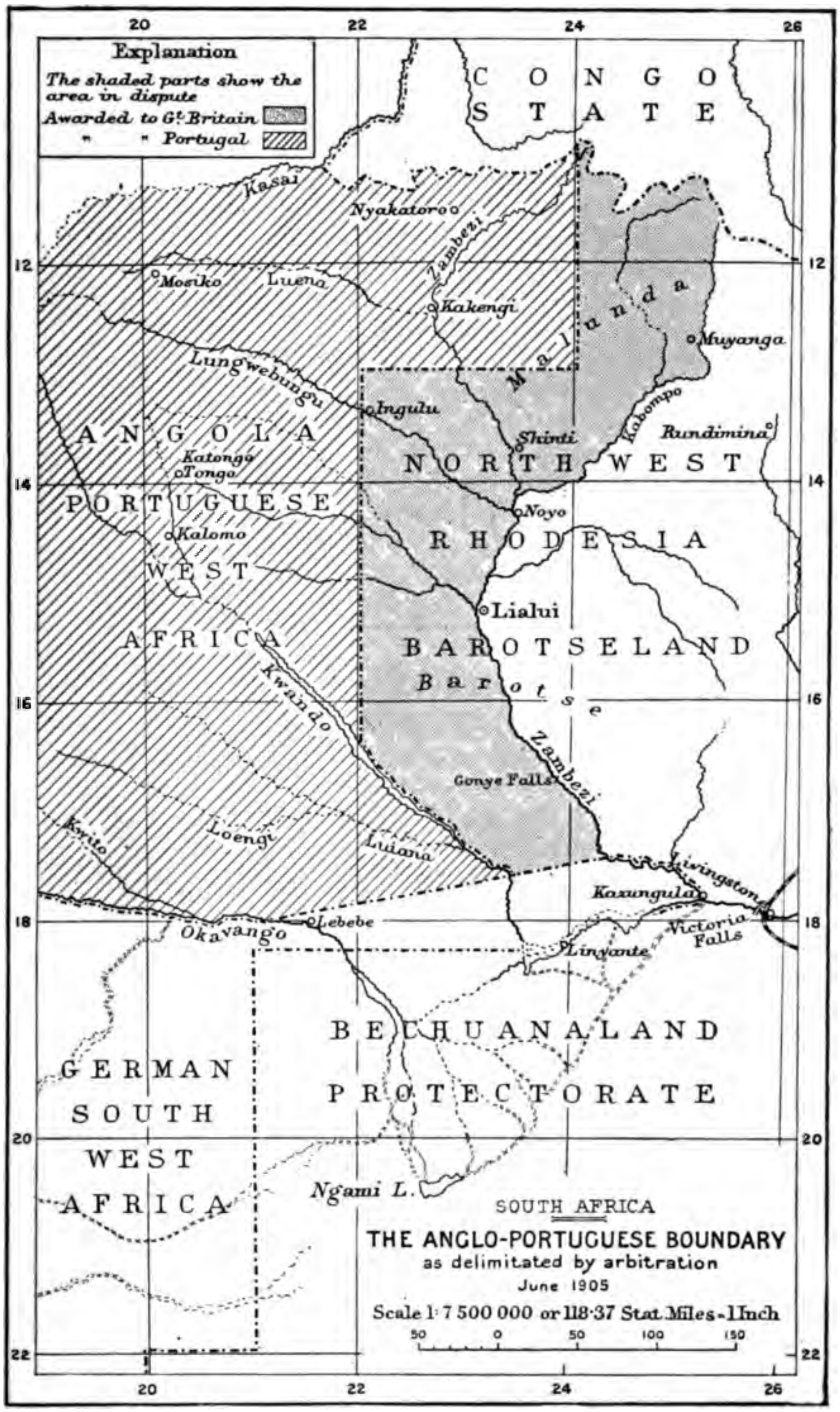
Owing to the length of time during which the question has been pending, it may be of interest to recapitulate the principal phases through which it has passed. The first attempt to reach a settlement was made in 1890, the year in which so many of the conventions determining the partition of Africa among the Powers were signed. In that year an agreement had been arrived at between the two Governments, but, owing to strong opposition in certain quarters, never received the necessary ratification. By this agreement, the course of the upper Zambezi and of its eastern branch, the Kabompo (then still by some regarded as the main headstream), was chosen as the dividing line between the two spheres. In the following year, after lengthened negotiations, a revised treaty was signed, and in due course ratified, according to which a basis for the final delimitation of the territory was arrived at, the actual work of fixing the boundary being left to a joint commission acting on behalf of the two powers. This was owing to the somewhat peculiar conditions under which the treaty was negotiated, neither contracting party possessing any definite knowledge of the greater part of the territories and tribes dealt with. Dr. Livingstone, then the principal authority on the upper Zambezi basin, had not left the immediate neighbourhood of the river until much further north; while at the time of his journey the normal tribal relations were suspended owing to the temporary supercession of Barotse sovereignty by the Makololo, a distinct and foreign people. Shortly before the convention was signed, however, Lewanika, paramount chief of the Marotse and neighbouring tribes, had gratuitously placed himself under the protection of the "Great White Queen," hoping thereby to best preserve the integrity of his dominions. This

British protectorate over the Barotse kingdom was in 1891 recognized by Portugal, the convention providing that the western limit of the territories of that kingdom should also form the international boundary. Great Britain therefore obtained distinctly more favourable terms in this region than by the abortive treaty of 1890; but, on the other hand, it must be remembered, the change on the lower Zambezi was equally to the advantage of Portugal.

The settlement of the question thus depended on the precise determination of the extent of the Barotse territories to the west of the Zambezi, and it is no matter for surprise that, when it became known that Lewanika claimed authority in this direction as far as the Kwito river, difficulties should again have arisen to delay a final arrangement. This led to the adoption of the *modus vivendi* of 1893, put forward by the British Government, which had recourse, as a provisional frontier, to the line fixed in 1890, though it was expressly stated that this should in no way prejudice the final decision. In the mean time, however, both sides were pledged not to extend their influence in any way across the Zambezi-Kabompo line in the direction of their neighbour's sphere, as had already, in fact, been provided for by an earlier *modus vivendi* of November, 1890. Portugal thus obtained, for the time being, a free hand in the disputed territory, Great Britain being, on the contrary, debarred from action within it. This state of things has been maintained until the present time, the proposed mixed commission for the delimitation of the territory on the spot having never taken shape, the alternative of arbitration being, after much delay, decided on.

As in so many previous cases, the decision is purely of the nature of a compromise. By the strict letter of the Convention of 1891, there is no doubt that this country might have expected to receive a larger share of the disputed territory, the line adopted certainly leaving to the west a considerable area over which Lewanika has exercised authority. Thus, as we are informed by Major Gibbons—the best, in fact the only first-hand, authority on much of the country in question—the principal chief of the Malunda tribe, which is apparently admitted to be subject to Lewanika, has been placed outside the larger part of his own dominions. On the other hand, the adoption of the Zambezi-Kabompo line in 1890, and again in 1893, was no doubt taken by the arbitrator as an indication that by following the strict letter of the agreement of 1891, its spirit would have to some extent been departed from. Be this as it may, geographers must certainly regret that the old unfortunate system of bounding political spheres by arbitrary lines, without any reference to physical, political, or ethnological facts, has in this case received a new lease of life.

As regards the value to this country of the territory assigned under the late award, Major Gibbons, who, from his personal acquaintance with it, is well qualified to pronounce an opinion, writes as follows:



Explanation
The shaded parts show the area in dispute
Awarded to Gt Britain
" " Portugal
CONGO STATE
Kasai
Nyakatoro
Zambezi
Mosiko
Luena
Kakengi
Malunda
Muyanga
Lungwebungu
Ingulu
Kabompo
Shinti
Rundimina
ANGOLA
Katongo
Tongo
NORTH WEST
PORTUGUESE
Noyo
Kalomo
RHODESIA
WEST
Lialui
AFRICA
BAROTSELAND
Kwando
Barotse
Zambezi
Gonye Falls
Loengi
Luiana
Kwito
Livingstone
Kazungula
Okavango
Lebebe
Victoria Falls
Linyante
BECHUANALAND
GERMAN
PROTECTORATE
SOUTH
WEST
AFRICA
Ngami L.
SOUTH AFRICA
THE ANGLO-PORTUGUESE BOUNDARY
as delimitated by arbitration
June 1905
Scale 1:7 500 000 or 118·37 Stat. Miles = 1 Inch

"Unfortunately, when quality is considered, it must be admitted that the few miles to the east of the 24th meridian contain the only district that can ever be available for European settlement. This is for the most part between 4000 and 5000 feet in altitude, and has good prospects from the agricultural, pastoral, and probably mineralogical standpoint. It is well watered and healthy. The plain which lies between the Zambezi and Kwando, and extends to the Lungwebungu in the north, is perhaps the only useless district in the whole of the upper Zambezi basin. The greater part of it is a dry wilderness in the dry season, and swampy during the rains—flat, riverless, and poor. The northern half of this, where within hail of the Zambezi, Lungwebungu, and Luanguiga, and their subsidiary streams, may serve the purpose of a native reserve."

The accompanying sketch shows the position of the new boundary adjusted to Major Gibbons's map of 1901, but it is to be remarked that unless this was also adopted as authoritative by the arbitrator, the line as here drawn may not entirely represent his intentions in regard to the relation of the boundary to the general geography of the country.

SOME RECENT IMPROVEMENTS IN SURVEYING INSTRUMENTS.

By E. A. REEVES, F.R.A.S., Map Curator and Instructor in Practical Astronomy and Surveying, Royal Geographical Society.

In my paper read before the British Association in 1903, I endeavoured to point out the necessity for more accurate geographical survey work than has been attempted by the pioneer explorers and travellers of the past, and described briefly how this could be accomplished and the instruments most suitable for the purpose. If more accurate work has to be done, instruments capable of greater accuracy of observation than those carried by explorers for rough route-surveying must be used, and I have therefore lately given considerable attention to the subject of light and portable instruments suitable for the purpose of geographical surveying of the present time, and have made alterations to several instruments which will be briefly described in this article.

The most important instrument for the geographical surveyor is doubtless the transit theodolite; but this instrument in early explorations was rarely carried, as it was generally considered to be too heavy and bulky. The smaller vernier theodolites reading only to 30″ or even 20″ are not sufficiently accurate for astronomical observations, and to take a larger instrument was usually considered out of the question on small expeditions. Recently, instead of the ordinary verniers, micrometers have been more commonly fitted to theodolites, and these greatly increase the accuracy of reading, for although the micrometer head is usually only divided into 5″ or 10″, by estimation readings very much nearer can be taken. But these micrometers, and the projecting arms upon which they are carried, make the instrument very bulky, so that it has to be packed in two cases instead of one; besides which, they are very liable to be deranged and put out of adjustment. These reasons, together with the considerable additional cost owing

FIG. 1.

to the necessity of constructing four separate micrometers, have led me to see if it is not possible to construct a micrometer for theodolites which, while giving considerable accuracy of reading, shall be simpler, not so liable to be put out of adjustment, and less expensive; and in this I think I have more or less succeeded.

The Tangent Micrometer.—Fig. 1 shows this new micrometer arrangement fitted to the horizontal circle of a theodolite. *a* is a clamp screw of the ordinary pattern, and *b* the tangent screw, turned by the milled head *e*, for making the exact contact of an object on the intersection of the cross-hairs in the telescope. The tangent screw *b*, which is specially constructed for the purpose, carries the pointer *d* and the micrometer drum, the central part *k* of which, with the pointer *d*, is rigidly attached to the tangent screw. The outer rim or dial *c*, upon which are engraved the numbers representing single minutes and tens or fives of seconds of arc, also carried by the tangent screw, is separate, and only attached to the central part *k* by a spiral spring inside the drum. By means of this spring the outer rim or dial *c* is, in its normal position, kept with the 0, or zero, opposite the pointer *d*, which is effected by the stop *s*, attached to the dial *c*, being pressed by the spring against the pointer *d*. *g* is a clamp actuated by the lever *f*, by means of which the dial *c* can be firmly held in any position; in which case, when the tangent screw is turned the pointer *d* revolves without moving the dial *c*, and points to any required number on the dial. However, immediately the clamp *g* is released, the dial, actuated by the spiral spring, returns to its normal position with the 0 opposite the pointer.

Instead of a vernier, the upper plate carries a fine pointer, *i*, or two lines cut on glass, which overlap the degree and minute divisions on the divided arc of the lower plate, and these serve as an indicator as in the ordinary theodolite micrometer. There are two of these indicators, 180° apart, whilst *h* is a reading microscope for setting the indicators.

The differences of the measures of the tangents between any two intervals of ten minutes of arc for the degree or two represented by the run of the tangent screw from its centre to either end of its run are practically equal, especially as the micrometer drum is divided for a position midway between the centre and end of the run.

To use the tangent micrometer: When the clamp g is released, the pointer d remains at 0, the tangent screw, dial, and pointer all turn together, and the screw acts exactly as an ordinary tangent screw. Therefore, with the clamp g released, make the contact of a star or terrestrial object in the ordinary manner, adjusting finally with the tangent screw. To take the reading, first clamp the dial c, and looking through the reading-glass h, it will be seen that the pointer or indicating lines i are somewhere between two marks (10′ or 20′) on the arc. Now turn the milled head e of the tangent screw in the direction shown by the arrow, until, looking through the reading-glass h, the two indicating lines i include the preceding 10′ or 20′ mark, or that next less in reading than the position in which they stood when the contact of the object was made.

The complete reading will then be the reading on the arc—the degrees and the next less 10′ or 20′—plus the minutes and seconds of arc on the micrometer drum as shown by the pointer, as in the case of the ordinary micrometer. Both "A" and "B" readings can be taken with the same micrometer, for having taken the "A" reading as shown here, look through the other reader and take the "B" reading in exactly the same manner.

Any reading can be set upon the arc by reversing the above operation. To do this, first set the indicator i to the preceding 10′ or 20′ mark, then turn the drum of the micrometer until the pointer d indicates the required odd minutes and

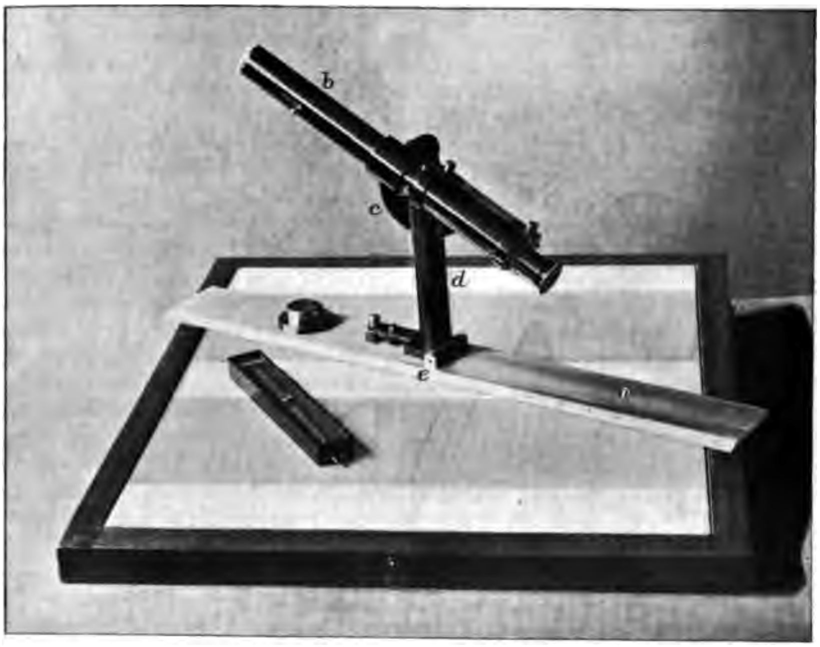


FIG. 2.

seconds. When this is done, clamp the drum of the micrometer and turn the tangent screw in the opposite direction to that for ordinary reading until the pointer d is at 0° on the micrometer drum.

The figure shows the micrometer fitted to the horizontal circle of the theodolite, but a similar one is also fitted to the vertical circle for reading altitudes.

This micrometer (which has been patented) is made by Casella, 147, Holborn Bars, E.C., and can be fitted to any ordinary theodolite.

Folding Telescopic Sights for Plane-table.—All who are accustomed to the use of the plane-table in surveying, know how much more accurately intersections of distant points can be made with a telescopic alidade than with the ordinary one; but the difficulty hitherto has been that the telescope is usually combined

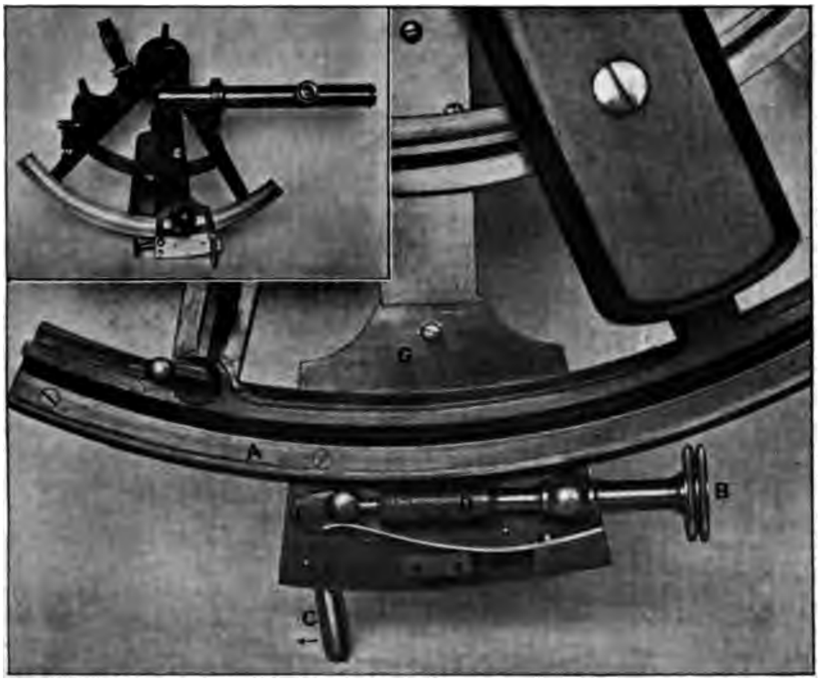


FIG. 3.

with other elaborate arrangements which have added much to the weight and expense of the instrument. It has therefore generally been necessary for the geographical surveyor to content himself with a plane-table with the ordinary rough sights, as the more elaborate instrument, which is, as a rule, a sort of plane-table and theodolite combined, is quite unsuited for the work he intends to do.

I have therefore had constructed a plane-table of the usual pattern, as shown in Fig. 2, but instead of the ordinary sights, upon the ruler a there is fitted a small and light telescope, b, with cross-wires, and a small vertical arc, c. The telescope pedestal d is hinged to the ruler at e, and the telescope and pedestal can be folded flat with the ruler. The whole can then be packed into a shallow box hardly any deeper than that which contains the ordinary alidade. The telescope and pedestal being constructed of aluminium, there is hardly any additional weight, whilst the advantage for accurate sighting at distant points has proved to be considerable. The plane-table is of the ordinary simple pattern, but possesses a clamp and tangent screw for making accurate contacts.

Automatic Clamp and Endless Tangent Screw for Sextant.—The other improvement to which I would direct attention is an automatic clamp and endless tangent screw which I have designed for sextants. As is well known, it often happens that just at a critical moment in the middle of a set of altitudes, the end of the run of the tangent screw is reached, and great inconvenience and delay results. This is specially trying in the middle of a set of sextant altitudes. Fig. 3 shows a new clamp and tangent screw which obviates this difficulty, and now that it has been fairly perfected is working extremely well.

A is the section of the back view of an arc of a sextant, B the tangent screw upon which the endless thread D has been cut. C is a lever which, when pressed by the fore finger in the direction of the arrow, raises the screw D from the arc A by means of the cam arrangement F, in which case the vernier arm G can be freely moved to any position on the arc, and the approximate contact made in the ordinary manner. When this is done, by releasing the lever C, the screw D, actuated by the spring H, is pressed hard against the arc and automatically clamps the vernier arm G. The final and accurate contact is now made by turning the tangent screw B with the endless thread D, which causes the vernier arm to move slowly along the arc, as far as required, without the possibility of the screw coming to an end. The plane-table telescope and the endless tangent screw for the sextant (patent) are made by Cary, Porter & Co., 7, Pall Mall, S.W. Any sextant can be fitted with the latter at a small cost.

REVIEWS.

EUROPE.

A Mountain Observatory.

'Twenty Years on Ben Nevis.' By W. T. Kilgour. Paisley: A. Gardner. Pp. 154. *Map and Illustrations. Price 1s. 6d. net.*

The writer, who was intimately associated with the observatory on Ben Nevis during the greater part of its existence, "has endeavoured to tell in simple language something of the joys and sorrows, the exploits, the vicissitudes, and the reminiscences of the observers, as well as to portray the more outstanding incidents inseparable from an existence spent at such an altitude." He appeals to the public to agitate for the re-opening of the observatory, and in this all who are acquainted with the excellent work done during the time it was in being, will certainly be at one with him.

AFRICA.

South Africa.

'Die Kalahari.' Versuch einer physisch-geographischen Darstellung der Sandfelder des südafrikanischen Beckens. Large 8vo. Berlin: Dietrich Reimer (Ernst Vohsen). 1904.

In the author's usage, the term "Kalahari" includes the whole interior of South Africa north of the Orange river and west of a line drawn south from the confluence of the Kafue with the Zambezi, the region being bounded on the west by the high country behind the Damara-Namaqualand coast. This is a very great extension of the district, usually known as the Kalahari, but the author justifies his usage by the fact that superficial deposits of the greatest importance in the physical history and conditions of the country characterize the whole area. Dr. Passarge's travels covered the middle portion of this great region, and his observations are very fully given in chaps. vi.–xxix. These chapters are such a mine of facts, that it would be difficult to gather their general bearing were there not frequent summaries and lists of conclusions, which are again brought under review in chaps. xxi.–xxxvii., where they are combined with the results of previous travellers relating not only to those parts of the Kalahari not visited by him, but to the whole of South Africa, and in some cases to tropical and North Africa also. One very great use of the detailed account of the middle Kalahari will be to form a basis for comparison in the future. Dr. Passarge pays great attention to the superficial deposits, *débris* from the underlying rocks, tufacious limestones, sand, rocks formed by the cementation of the sand by silica, and by the replacement of carbonate of lime by the same substance, laterites, and various river and vley deposits. The interest of these is not confined to the Kalahari, for they spread to the southern end of the continent. Dr. Passarge's researches (in which he received great help from Prof. Kalkowsky, the petrologist at Kiel) are the first attempt to deal with them on broad lines. To a Cape geologist who believes he has evidence of the formation of silicified rocks at the present day, the author's reasons for regarding their analogues up-country as the result of desert conditions which prevailed during the period between Upper Cretaceous and Pliccene (p. 649) are not conclusive. This question is intimately connected with a series of climatic changes since Karroo times, which the author endeavours to unravel. The evidence is not always convincing, *e.g.* that from Middelburg district in Cape Colony (p. 634); the presence of unweathered blocks of diabase (the Karroo dolerite of the Cape Geological Survey) on deeply weathered diabase is explicable without the assumption of desert conditions followed by a wet period which continued with diminishing rainfall to the present day. The diabase-capped hills, whose beautifully curved slopes owe their form to the action of running water as well as to the processes of insolation and wind-erosion, undergo little change by the action of ground water. Fragments broken from the diabase sheets lie undecomposed on the sometimes deeply weathered diabase of the lower ground, continuously subject to the influence of ground water. This contrast in the rate at which decomposition goes on in projecting and low-lying masses respectively, is particularly noticeable in the Transkei, where the climate is more favourable for chemical weathering than in the Karroo. The wide-spread tufacious limestone is certainly forming to-day, probably as energetically as during any period we have record of in Cape Colony—witness the choking up of small springs in the Karroo by calcareous matter left by evaporation of their water, and the thin calcareous crusts formed on bare spots after rain. These seem small details, but it is upon their like that our author's far-reaching conclusions are based.

Dr. Passarge makes out a very convincing case for his view that the Kalahari, in the wider sense, has become gradually drier, and that the process began in the south, and is extending northwards. In chap. xxvii. there is a very interesting account of the Okavango basin: a once well-watered low-grade river system is gradually losing its water, the valleys become converted into swamp lands, and these in their turn give place to sand-veld of the Kalahari type. This river system, which discharges both into the Zambezi and the Makarrikarri depression, was developed on an extremely old surface of the "Inselberglandschaft" type, *i.e.* there were wide plains covered with the products of insolation and wind-erosion and derivative rocks, through which isolated hills and short ranges of the underlying rocks projected. This kind of country, which is also met with in other parts of

Africa, is regarded by the author as the result of desert conditions which have prevailed with but one considerable interruption since at least the end of the Karroo period. The desert hypothesis is also held to account for the steep grade of African rivers (p. 637), but, as the author admits may be the case, the recent rise of the land has probably played an important part in giving the rivers their steep grades. At the south end of the continent there is evidence of a ri·e of 1200 feet, perhaps, within the period of living mollusca, and indications of a still greater "negative shore-movement" are not wanting, but the facts bearing on this question have not yet been consistently explained.

A full summary of the geology of South Africa is given in chap. iv., and the results are combined with the author's experience in chaps. xxiii. and xxiv., to form a mental picture of the development of the southern part of the continent. The summary is, on the whole, sound, and it is gratifying to find that the three subdivisions of the Cape system are taken to be successive formations, and the Black Reef—Malmani—Pretoria series to be older than the Cape system; the latter view is based upon a comparison of the tectonic structure of the north and south (pp. 47, 48), which has great weight. The value of the "Olifant-Komati line" as a division between two unlike portions of the country is not so great as the author thinks; a line which fulfils more of the conditions laid down (p. 63) joins the Olifant's mouth with the Keiskamma mouth, but this leaves the greater development of the Karroo beds to the north. On one important point the author is mistaken—the diabase intrusions so characteristic of the Karroo region are by no means confined to the middle and lower Karroo beds; they are almost or quite as conspicuous in the Stormberg series. Any one who writes an account of the development of the subcontinent on our present knowledge sets up a tempting mark for others to throw at, and it is only by a repetition of such processes that the story will illuminate the facts. Dr. Passarge shows that "Gondwana-land" may be much older than Suess thought it was, for the South African portion seems never to have been encroached upon by the sea since the Malmani-Campbell Rand limestones were formed, and these are of pre-Devonian age. The Bokkeveld (Devonian) encroachment was of short duration, and was confined to the south. A comparison of Natal and Pondoland with the western districts of the Cape does not support Dr. Passarge's suggestion (p. 595) that the Cape folded belt stretched eastwards beyond the Kaffrarian coast. No evidence has yet been produced to show that the west coast—at least, as far north as the Orange river—owes its form in any degree to faults. The statement on p. 596 that Karroo beds occur on the coast of Little Namaqualand is at best doubtful; neither is there evidence for the connection of the Drakensberg volcanic region with faults; recent work has upset the idea that the volcanoes are in linear series. Some, at least, of the south-east coast faults are post-Senonian; the great Worcester fault is much older than this, Triassic or early Jurassic in age, and the minor faults which follow the Worcester direction affect the Uitenhage beds, and may therefore be intermediate in age. Attention has already been called to the author's views on the post-Karroo history of the interior. Whether he is right in his succession of climatic changes or not, there can be no doubt that the interior has been dry land for a very long period.

The thirty-seventh chapter, a discussion of the meteorological conditions of the present and recent times, is of great interest to all South Africans, but it is not altogether pleasant reading. On p. 665 it is suggested that a stable condition has not yet been reached in South Africa, and the coming stability would seem to be another "Wüstenperiod"! Attention must be drawn to the admirable discussion of the importance of animal life, especially of mammals, in effecting surface changes in this region, given in chaps. xvi. and xvii., and to the numerous facts bearing on this matter throughout the narrative. A chapter on plant-life in the Kalahari, and appendices on the pronunciation of native names, maps and figures, astronomical observations, rock specimens, mollusca, and plants, close the book, but there are also excellent indexes. Whatever may be the fate of some of Dr. Passarge's speculations, all geographers and geologists owe him gratitude for the thoroughness of his observations and the labour he has spent on their presentment.

A. W. Rogers.

Among the Headstreams of the Nile.

'Caput Nili: Eine empfindsame Reise zu den Quellen des Nils.' Von Richard Kandt. Berlin: D. Reimer. 1904. *Illustrations and Map.*

This is a striking book, which will stand out as one of the more permanently valuable amid the multitude of more or less ordinary works of African travel. The author's contributions to African geography have long been known to our readers. He is one of the comparatively few explorers who have been content to work doggedly in a limited field until they have gained that intimate acquaintance with its characteristics which can never be acquired by the passing visitor, and he possesses other qualities which go to make a successful student of a new country, notably the spirit of inquiry which ever seeks to go below the surface of things. The result is that his book, though professing only to give such an account of his work as may be suitable to the general reader, contains abundant food for reflection for the more seriously minded, while running through the whole is a lighter vein which enlivens the record of many disheartening struggles with adverse circumstances. It is, however, his keen appreciation of the romantic and imaginative elements in his subject which above all distinguishes Dr. Kandt's book, and which justifies his designation of it as the record of a "sentimental" journey. Whether in describing the parched and all but lifeless vegetation of the African steppe, the imposing silhouettes of the Central African volcanoes, or the moist primæval forest which conceals the ultimate headstreams of the Nile, he is always able to seize the essential elements of the picture, so that the reader carries away with him an impression of life-like vividness. The region specially chosen as a field for exploration offers unusual scope for the exercise of such powers, and in describing his journey as one "to the source of the Nile," Dr. Kandt no doubt gives us the clue to the special attraction which it exercised upon him. Whether or no the claim thus made be regarded as justified, there is no gainsaying the fact that Dr. Kandt was the first to set eyes on the ultimate source of the famous river—in the sense of the origin of that branch which brings the largest supply from the greatest distance. And there is something, no doubt, to be said for the view that it is only in this sense of the word "source" that the use of the definite article is at all applicable—whether such use is, even so, justifiable on scientific grounds being another question. Dr. Kandt reserves for another volume the elaboration of arguments in support of his claim, though it may be doubted whether our knowledge of the meteorological and other conditions of this part of Africa is yet sufficient to allow a definite opinion to be pronounced on the question.*

* Some indication of the comparative *rôle* of the Victoria Nyanza and the Kagera in the economy of the Nile may, perhaps, be supplied by the consideration that while the loss of the supply received from the Kagera would seriously affect the status of the lake, there is no reason to suppose that, had the basin of the lake not existed, the supplies carried to the Nile by the river would have been materially lessened. But in order to reach any definite conclusion, some knowledge of the rainfall and evaporation on the surface of the lake and over the basin of the river is of primary importance. It

As regards the shores of Lake Kivu, which he surveyed with so much perseverance, Dr. Kandt gives likewise much new information. But it is not only for its delineation of natural features that the book is of interest. The author has much to say on the peoples with whom he was brought in contact, their characters and idiosyncrasies, which have evidently been the subject of thoughtful study on his part. His chapter on native caravan life, though not altogether pleasant reading, supplies, at any rate, an unusually vivid picture; while his accounts of the natives and political organization of Ruanda—of all African states the one which has longest lain off the beaten track, even of native lines of communication; of the Batwa dwarfs of the region of the great volcanoes; and of other tribes, such as the Bakiga, whose inveterate thieving habits gave him so much trouble, are of still higher interest in proportion to the little that has hitherto been written about them.

It should be mentioned that, while the freshness of the narrative is maintained by a liberal use of the diary form, the objections often attaching to this method are lessened by the very careful elaboration to which the original journals were subjected from time to time during the course of the journey, the results of more mature reflection or subsequent experience being in this way incorporated. Lastly, the avoidance of the use of the objectionable loaded paper, now so common, adds immensely to the attractiveness of the book, and in no way detracts from the clearness of the excellent illustrations.

WESTERN UGANDA.

'On the Borders of Pigmy Land.' By Ruth B. Fisher. London: Marshall Bros. [1905.] Pp. x. and 216. *Illustrations. Price 3s. 6d. net.*

This work is valuable as presenting the views and impressions of one who has not merely passed through the country at a rapid rate, but has resided in it for several years, maintaining a close and constant intercourse with the natives. The writer is the wife of the Rev. A. B. Fisher, who read a paper before the Society in 1904 (*Journal*, vol. 24, p. 249). There is a chapter on the pygmies, and another on the partial ascent of the Ruwenzori range.

ZANZIBAR.

'Zanzibar in Contemporary Times.' By R. N. Lyne. London: Hurst & Blackett. 1905. Pp. xii. and 328. *Maps and Illustrations. Price 10s. 6d. net.*

This is the first attempt which has been made to write the history of Zanzibar, and especially of British relations with it, in modern times. The author, who belongs to the Government service, has made careful researches in the archives of Government departments at home, and by his intercourse with past and present residents, has been able to place on permanent record many interesting details of the history.

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may, therefore, be worth while calling attention to what appears to be a fallacy in the estimate made by Sir W. Garstin (in his admirable and exhaustive report on the basin of the upper Nile) of the evaporation from the surface of the lake. Having estimated the amount of water entering the lake in one year (whether as rain or by rivers), and leaving it by the Ripon falls, he proceeds to obtain the "total cubic content of the water added to it in one year," adding this to the amount leaving the lake, and then deducting the sum from the amount received; the result being, in his view, the amount lost by evaporation. But in order to justify this proceeding, the amount taken as added to the lake should surely be the *net* gain during the year (supposing such to exist), and not the gross amount corresponding to the difference between the lowest and highest level, which is the quantity obtained by Sir W. Garstin on the basis of the mean annual range of level. His value for the amount lost by evaporation will thus be far too low, supposing the other estimates to be fairly correct.

AUSTRALIA.

Queensland in Early Days.

'Tom Petrie's Reminiscences of Early Queensland.' Recorded by his Daughter. Brisbane: Watson, Ferguson & Co.; London: J. Gray & Son. 1904. Pp. xvi. and 320. *Plan and Illustrations.*

Books such as this will become of increasing value as the race of early settlers dies out. The present reminiscences were taken down (by his daughter) from the lips of one who was associated with the Queensland aborigines from early boyhood, and gained an unusually intimate acquaintance with their manners, customs, folklore, and the like, a knowledge of which is here rescued from oblivion. There is also much that is of interest concerning the early settlement of the colony.

THE MONTHLY RECORD.

EUROPE.

Examples of River-capture in France.—M. E. Fournier calls attention in the *Comptes Rendus* of the Paris Academy of Sciences to some instances of river-capture which are remarkable for the very recent date at which the captures have taken place. The district is that watered by the Vallière and several of its tributaries, small streams belonging to the eastern part of the basin of the Sâone, in the department of Jura. By a study of maps and documents dating from the seventeenth century onwards, M. Fournier has found that the relations of these streams has several times changed during the last two centuries and a half, the Sorne, in particular, having (in one or other of its branches) suffered a constant displacement towards the north, abandoning in turn no less than three different channels by which it found its way to the Vallière. The accuracy of the maps and documents is confirmed in one particular by the fact that one of the later branches is crossed by the boundaries of properties as if it had no existence, while in most cases these follow the courses of streams. These examples are, perhaps, somewhat discounted by the fact that the district is part of an alluvial plain without much relief, in which changes in the courses of streams are only to be expected. A more striking instance, though dating from more ancient (if geologically recent) times, is the probable deflection of the course of the Vienne in the neighbourhood of Exideuil, a note on which has been contributed to the *Annales de Géographie* (March 15, 1905), by MM. Blazac and Vacher. The idea which has hitherto prevailed is that the sudden bend to the north made by the Vienne below Exideuil marks the position of a capture of its upper course, by a stream flowing to the Loire, at the expense of the Charente, the direction of which corresponds to that of the upper Vienne. This capture has been thought to have occurred in Pleistocene times, and the small stream flowing by the village of Pomaret has been supposed to occupy the abandoned channel leading to the Charente. As is pointed out, however, by the writers in the *Annales*, the facts do not entirely fit in with this view. The V-shaped form of the Pomaret valley near its confluence with the Vienne gives the impression of a recent valley, rather than of an old valley now drained in a reverse direction to the original; while careful search has failed to reveal the existence of alluvial deposits on the line of partition between this valley and the Charente. The authors do not, however, entirely reject the idea of a capture having taken place, but they point out the existence, on a line running from east to west across the plateaux between the Vienne and Charente, of a series of deposits, mostly fluviatile, at a much higher level than the present river valleys, higher, in fact, in places, than the water-parting between the existing rivers in the area under discussion. The age of these deposits is in all probability Pliocene, and the writers therefore conclude that a capture of the ancient upper course of the Charente took place either at the end of the Pliocene or at the very beginning of the Pleistocene age.

Transport Problems, especially in France.—Prof. Louis Lafitte, of Nantes, has recently published a series of articles on this subject in the *Questions diplomatiques et Coloniales* (July, August, and September, 1904). In them he points out how important a *rôle* improved means of transport play in modern economic expansion, internal and external. He notes the great reduction in cost of ocean transport in recent years—the rate per tonne from Marseilles to China being 335.70 francs in 1872, while it now is between 70 and 75 francs. Of means of transport, that by water is by far the most economical, and he gives as mean rates for France 1 centime, for German rivers, 0·8, and for the United States, 0·48 of a centime per tonne-kilometre. By *petite vitesse* the railway freight in France is 4·7 centimes per tonne-kilometre. In spite of low rates, Germans calculate that the cost of their products is raised 30 per cent. on an average, in Britain 15 per cent., and in the United States still less, owing to charges for transport, but that they save £3,400,000 per annum by using canals and navigable rivers. They have paid great attention to these rivers and canals, as recent monographs show, and also to harbour improvements with startling results. The traffic on the Rhine has risen of late by leaps and bounds, and the tonnage of vessels entering and clearing at Hamburg (with cargoes) has increased from 9,417,817 in 1892 to 14,414,370 in 1902. The French railways, by careful study of the international "transit trade," have greatly added to their incomes, and compete successfully, for instance, for English, Swiss, and Italian traffic, the quickest route by the St. Gothard being *viâ* Boulogne and Laon. The tourists from London to Switzerland by the Belgian route was 7149 in 1898, but only 4521 in 1902 (decrease 42 per cent.), whereas by the French line it was 7833 in 1898, but 17,685 in 1902 (increase 172 per cent.). New cross-country routes are recommended—that from St. Nazaire and Nantes by Tours, Bourges, Nevers, and Chanzy is meant to secure Swiss trade through Belfort and Lons le Saunier; and even Austrian traffic through the former, and Italian trade through the latter and the new Simplon tunnel. Several programmes for the amelioration of French waterways have been drawn up. Political as well as economic reasons have resulted in the north-eastern system, serving Paris alone, being well developed. The latest, that of Pierre Baudin, will not only add to the utility of these north-eastern waterways, especially by improving the Seine and the chief harbours, but will revive the Loire as a navigable waterway (where the tonnage between the Maine and Nantes has sunk from 303,431 in 1866 to 92,541 in 1902), and provide for greatly needed improvements at Nantes and St. Nazaire. Bordeaux, the Canal du Midi, the Rhone, and Marseilles will be ameliorated, and, what is perhaps most important, the long-talked-of tunnel to connect Marseilles with the Étang de Berre and the Rhone will at last be carried out. By such improved waterway and railway services, the French, examining the geographical conditions and striving to utilize them fully, hope not merely to improve their own internal trade, but to secure a greater share of the *entrepôt* trade.

Vertical Earth-temperature Gradient above the Simplon Tunnel.—The temperatures observed in the rocks of the Simplon tunnel are discussed by Mr. F. Fox in the *Proceedings of the Royal Society* (vol. 176, pp. 26–33, April, 1905). The figure is 97·°7 Fahr. (54·°3 C.) at 2135 metres below the summit; and assuming that at 10 metres below the surface of the mountain the temperature is 0° C., the temperature gradient is 1° Fahr. to 71·5 feet (1° C. to 39 metres). Taking the mean of the altitudes above and temperatures at stations between the 8 and 13 kilometre posts in the tunnel, the vertical gradient works out at 1° Fahr. to 67·5 feet (1° C. to 37 metres). The Simplon data thus correspond very closely with the average value which is derived from previous observations in tunnel mines and boreholes.

Trade of Bosnia and Herzegovina.—The Government returns of imports and exports for Bosnia and Herzegovina issued since 1898 indicate a steady increase of exports down to 1902. By weight the imports stood to exports in 1898 as 1 to 2, but in 1902 as 1 to 3·1. The year 1903 still showed a rise in exports, but a still greater rise in imports; so that the proportion between the two was 1 to 2·3. The great increase in imports was due to the greater demand for corn consequent on the bad harvest of 1902, and to the increased import of live-stock both for slaughter and draught. Though in this respect the imports fell from 13,000 head in 1900 to 5000 in 1902, the figure has still risen from 9000 head in 1898 to 20,000 head in 1903. The export, on the other hand, has risen from 244,000 to 328,000 head. The previous year it had mounted to 349,000. These last advances are to be explained by the building of the railway from Serajevo to the Turkish frontier. The foreign trade of Bosnia and Herzegovina consists, roundly speaking, in an exchange of natural for industrial products. Owing to the unfavourable weather during the period in question, the export of cereals did not reach the figure that might be expected. Timber for building and other economic purposes, as also horned cattle and dried plums, have, on the other hand, shown a greatly increased export, the former by the value of 14 to 15 million crowns (1 crown = 10s.), the latter by 6 millions. The greatest increase in imports has been in clothes and linen and in articles of food and luxury, such as coffee, sugar, wine, and butter, as also in machinery and implements. Of the last item, the greatest portion comes across the Croato-Slavonian frontier, the import thence during the period in question having risen from 79 to 86 per cent., whereas the export thither fell from 87 to 68 per cent. of the total. By way of the Dalmatian frontier, on the other hand, the import has fallen from 19 to 13 per cent., whereas, thanks to the railway connections constructed during the period, the export has risen 2½ fold; 75 to 77 per cent. of the import and export now running on the railway lines. Water and road communication in Bosnia and Herzegovina, as throughout the whole of Austria, has declined considerably commensurately with the increased use of railway transport.

ASIA.

Mineral Resources of Ceylon.—With a view to an estimate of the economic mineral resources of Ceylon, two English geologists have, under the general supervision of Prof. W. R. Dunstan, of the Imperial Institute, been at work since March, 1903, surveying the island. Between April 6, 1903, and January 7, 1904, they have transmitted to the Institute seven reports, and with each report specimens of minerals collected by them. The specimens thus transmitted have been carefully examined in the scientific and technical department of the Institute. An account of the results of such work in 1903-4 is embodied in a Colonial Report (Miscellaneous, No. 29, 1905). The mineral products, collected during the survey, or obtained from other sources, which had been investigated at the Imperial Institute, includes ores of iron, manganese, and copper, ores containing thorium and cerium, the oxides of which are available for incandescent gas-lighting; graphite, mica, steatite, kaolin, laterite, asbestos, limestone, quartz, chert, corundum, and various gem-stones. The iron ore is in all cases a surface deposit, due to the decomposition of the older rocks, and up to the present has not been found in sufficient quantities to be economically important. Nor apparently does manganese ore exist in quantities available for export, but the presence of 1·61 per cent. of cobalt in the manganese ore from Ampitiya calls for further investigation. The most important discovery, however, is that of several minerals containing thoria. Taken to be uraninite, or pitchblende, and forwarded as such to England, one of these minerals, on complete analysis at the institute, proves to be a new mineral which it is proposed to name thorianite. It is one of the richest known in the rare earth thoria, of which it contains more than 75 per cent. uncombined with silica. Thoria is of very considerable value on account of its employment in the manufacture of incandescent gas mantles. At present the material is chiefly extracted from the monazite sands of Brazil, containing 5 to 10 per cent. of combined thoria. The announcement of the discovery of thorianite in Ceylon, as well as "thorite," containing over 65 per cent. of thoria, has already called forth many offers from England and the continent to purchase the material or work the deposits. At present, however, only a few tons are in sight. For the determination of the extent of the occurrence of the above minerals in Ceylon, further exploration is needed.

AFRICA.

Progress in Egypt and the Sudan.—Lord Cromer's report for 1904 records as satisfactory an amount of progress as any of the preceding ones. As regards Egypt, it is stated that the year under review was one of "unexampled prosperity," though the writer wisely sounds a note of warning against an "exaggerated optimism," of which he thinks there may be some risk. Of topics of specially geographical interest, reference may be made to the increased grant for the geological survey, to enable it to be pushed forward with greater rapidity, and to the proposed beginning of a proper hydrographical survey of the Nile, in the form of a determination of levels along the river-banks, the establishment of a gauging station above the second cataract, and other works. The meteorological stations in Egypt and the Sudan are to be more completely equipped, and their observations published, while preparations are being made for the measurement of an arc of the meridian, as recommended by the International Geodetic Congress. It is also of interest to note that, so far, the state of the temple at Philæ is extremely satisfactory, though it is no doubt too soon to pronounce whether damage may eventually result from the flooding. The proposed heightening of the Assuan dam has been abandoned for the present, so that further measures for the protection of the temple, which might be necessary in view of the further submergence which would result, need not yet be discussed. In the Sudan, the progress in the direction of increased security and confidence in the intentions of the Government is decidedly satisfactory. Even on the remote frontiers the central authority is becoming gradually recognized, and much good seems to have resulted from the demarcation of the frontier with Abyssinia. On the side of the Congo State agreements have been arrived at between the Anglo-Egyptian and Belgian authorities regarding the northern boundary of the Lado enclave and the "Thalweg" of the Nile between Lado and 5° 30′ N., but at the date of the report they had not received the formal ratification of the Congo Government. Difficulties which had arisen with the Nyam-nyams have been completely removed, as the result of a military expedition under Major Boulnois, and in the same direction it is hoped to develop trade with the French Congo territory, by placing a small steamer on the Jur river. Various expeditions have been undertaken for the exploration of little-known districts, including one under Mr. Dupuis for the further examination of the country traversed by Captain Liddell (*Journal*, vol. 24, p. 651) with a view to ascertaining the possibility of opening up a new river-channel from Bor to the Sobat. An exploration of the Pibor, or south-western branch of the Sobat, was made by Lieut. Comyn, who succeeded in penetrating far beyond the junction of the Akobo, but was stopped by shallow water when within about 60 miles of Bor, so that the ultimate source is still a matter of uncertainty. Mr. Macmillan, the results of whose expedition have been given in the *Journal* (vol. 25, p. 158) has despatched Mr. Jessen for further exploration between the White Nile and Abyssinia. Useful work has already been done by Captain Borton, by Lieut. Bayldon, R.N., and others, in various parts of the Bahr-el-Ghazal province, the latter having collected information on the Bahr-el-Arab and other streams of the north-west, while Captain Percival has undertaken an expedition south from El-Obeid to Wau with a view to further elucidate the hydrography of this region.* The cutting of the sudd, both on the Bahr-el-Jebel and on the Bahr-el-Ghazal, has been continued with much perseverance, while the detailed surveys under the direction of Colonel Talbot, R.E., have been actively prosecuted. Lastly, reference should be made to the rapid progress made on the railway from the Nile to the new Red sea port near Suakin, which it is hoped to complete by the spring of 1906.

Agriculture in British East Africa.—The latest official reports (Africa, No. 4, 1905) from the Director of Agriculture on the Nairobi and Naivasha farms, tell the tale of abnormal drought in 1904. A special report, appended to these returns, sets forth summarily the main conditions new settlers in the protectorate have to reckon with. The rainfall at Naivasha in 1904 amounted to but 21·87 inches, at Nairobi to 27·40 inches—a supply altogether inadequate to the wants of a porous soil under a tropical sun. The month of largest rainfall at Naivasha in 1904 was November, with 2·87 inches; of smallest, January, with 0·53 inch. At Nairobi 5·83 inches fell in November, whereas September was rainless. At Naivasha the mean temperature in November was 63°·13 Fahr.; at Nairobi the mean monthly temperature was 64·09° Fahr., the maximum for the year being 84°, the minimum 44°. The life and experiments on the two farms are illustrated by photographs. The agriculture of the protectorate, though not yet adequately represented in the exports, is proceeding at a fair pace. East Africa, which two years ago counted not more than six European farmers, now counts as many hundreds. The main sowing begins with the first of the greater rains (March—May), the crops ripening in the dry months from June to October. The tropical region, hitherto eyed askance on account of its climate, is a coast belt 100 miles broad, its richest strip lying within 20 miles of the sea. About 100 acres of it are now planted with cotton, of which it should yield 300 to 400 lbs. per acre in the form of lint. Rubber (*Landolphia*) is most widely distributed. Sanseviera grows wild, producing fibre 3 to 7 feet long, valued at £25 per ton. A variety of fruits are cultivated by the natives, but, ignorant as they are of grafting, the fruit they raise is poor. In view of a ready market in the temperate regions, Mombasa, and the ships, there is here a good opening for fruit farms. It is also pointed out how profitable would be a dairy business near Mombasa, supplying the town, ships, and Zanzibar. In the central districts, from 100 to 250 miles inland, Indian settlements are making rapid progress. The cotton crop is estimated to yield about 1400 lbs. per acre. Besides cotton, the climate is suitable, probably, for Ceara rubber and fibres, and large concessions have been taken up for

* Captain Percival has successfully completed this expedition, and has returned to this country.

working these products. In the lake district many Europeans have settled, attracted by the richness of the land and abundance of rain.

Volcanic Formations in the Sahara.—A note in the *Comptes Rendus* of the Paris Academy of Sciences for May 1 last gives the results of the geological researches during M. Foureau's trans-Saharan expedition, as far as concerns the distribution of volcanic formations in the regions traversed. The first rocks of this nature were picked up north of, and in, the great Erg, in the form of scoriæ and basaltic lavas, having their origin, probably, in the Ahaggar massif; the eruptive nature of certain mountains in which, spoken of by Duveyrier, is thus confirmed, as it is also by recent explorations by Lieuts. Guillo-Lohain and Besset. Duveyrier has also been shown to be correct in his view of the geological character of the southern crest of the Tassili, which has also yielded basaltic scoriæ. Volcanic formations are extensively represented in the "Adrar," where, besides basalts and phonolites, tephrites with olivine play an important part. But the greatest development of volcanic formations occurs in southern Air, where a whole series of lavas, scoriæ, and tuffs seems to descend from the peaks of Taguet, Kombo, and others further east. These basaltic volcanoes seem to be of quite recent age, to judge from the frequent occurrence of cirques and basins, which seem to represent the actual craters of the volcanoes.

AMERICA.

Exploration in the Sierra Madre, Mexico.—An expedition for the study of the geography and geology of the western Sierra Madre of Mexico was organized early in the year by Colonel W. C. Greene, and left New York on February 4. The party consisted of Mr. R. T. Hill, Dr. E. O. Hovey, and assistants, and the scientific qualifications of the gentlemen named promise valuable results as regards the physical geography of the interesting region chosen as a field of work. Communications by Dr. Hovey, printed in *Science* for April 14 and June 9 respectively, give a summary of the doings of the party while exploring the northern part of the Sierra Madre. A delay at El Paso, caused by snowfall in the mountains, was utilized for a run across the arid region along the Mexican boundary as far as Naco, Arizona, and thence to Cananea, Sonora, the railway route followed affording excellent opportunities for study of the geological processes at work. Dr. Hovey mentions especially the *bolsens*, or pocket deserts (with accompanying volcanic cones and basaltic floors), containing underground watercourses, and supplying, by means of shallow wells, abundant water for mining purposes. The Mesa phenomena of the region were specially studied. From El Paso the party went south-westward by railway into Chihuahua, making studies *en route* of the vast llanos, the peculiar moving sand-hills known as "los Medanos," the lost mountains, and the shallow periodical lakes without outlet which receive the drainage and wind and water-borne *débris* from the Sierra Madre. From Lake Guzman the route followed the San Miguel river, in part through deep tortuous cañons, to its headwaters on the undulating plains of the Sierra Madre plateau, more than 7000 feet above the sea. From Casas Grandes, the terminus of the railway (where a visit was paid to the prehistoric ruins which give the town its name), the journey was continued on horseback and with pack-team across the high plateau to Dedrick, consisting of one or two log houses in the midst of the forest of long-leafed yellow pine which characterizes the plateau and peaks between 7000 and 8000 feet. Immediately to the west of this is the stupendous cañon of the Yaqui, which in beauty and grandeur rivals that of the Colorado. Important facts relating to the physical history of the region were observed, and the ruins left by the cliff-dwellers and other prehistoric peoples examined. From Guaynopita, a little mining camp on the mountain-side, a climb of 3500 feet led out of the cañon on to the great Mesa, out of which the mountains have been carved. Here the contest for the drainage of the plateau between streams flowing east and west was observed, the dissection being more pronounced to the west. The cañon of the Tutuaca (a tributary of the Yaqui) disclosed a section through vast beds resulting from igneous action, which has been accompanied and followed by strong mineralization of veins. The further route led across a series of high mesas, divides, "arroyos," and river channels, until it finally reached the crowded mining camp of Ocampo. Hence to Miñaca, the terminus of the Chihuahua and Pacific railway, the high mesa was again crossed, the train being taken back to El Paso, so as to complete a circuit among the Western Sierra Madre mountains. The detailed reports on the journey will be awaited with interest.

Natural Mounds in the United States.—A paper read by Mr. A. C. Veatch at a meeting of the Biological Society of Washington in January last, and reported in *Science* for February 24 (vol. 21, No. 530, p. 310), has revived the interest in the question of the origin of the natural mounds found in so many parts of the United States, which have been the subject of discussion for a number of years, without, however, any decidedly satisfactory explanation being arrived at. A discussion has since been maintained in the pages of *Science*, in which Profs. Branner and Hilgard, and other observers who have paid attention to the problem, have taken part (see Nos. 535, 536, 538, and 543). The evidence adduced is on certain points conflicting, and there can be little doubt that the observations have to do with phenomena of diverse origin, however striking the superficial resemblance may be. In any case, it is remarkable how widely distributed over various kinds of country such mounds (known sometimes as "hog-wallows") appear to be in the United States, whereas in hardly any other part of the world have such features been observed in sufficient numbers to attract general attention. Mr. Veatch considered especially—among the various theories put forward—those which explain the mounds (1) as due to the action of gas vents and springs; (2) as a form of dunes; (3) as the work of ants; considering that the last has most in its favour, whether we suppose the agents to have been the "atta," or leaf-cutting ants, or the mound-building variety of termites. But if either of the theories (2) and (3) be correct, he considers that important climatic changes must have taken place in very recent times. Dr. Branner, speaking especially of the mounds of California and Oregon, where they cover hundreds of square miles, points out that they extend from the valley floors to a height of over 500 feet up the slopes of the foothills, and that the underlying rocks vary from Pleistocene gravels, sands, and clays to granites, schists, and folded Palæozoic slates. The form seems to differ from that of existing ant-hills, though on this he lays no great stress. Sections show no differentiation of structure from the surrounding areas, though the soil is generally hard and clayey, sometimes with quartz, feldspar, etc., and is not regarded as good. As an alternative to the ant-hill theory, Dr. Branner throws out the suggestion of a possible "concretionary action on a large scale due in part to chemical and in part to physical conditions." Prof. Hilgard decidedly favours the idea of an ant-hill origin, and shows that existing species of ants produce a counterpart of the Louisiana mounds, though the causes which led to the depopulating of the latter are still obscure. He mentions examples of mounds which are certainly due to wind or water action. Mr. W. J. Spillman thinks that the mounds have originated in various ways, and that in South-West Missouri they may be attributed to the occurrence of concretions of flint in the sub-Carboniferous limestones. Elsewhere, however, he says that the mounds are specially marked by the luxuriance of the vegetation on them. Lastly, Mr. A. H. Purdue, after pointing out that existing ant-hills (which, in the Arkansas valley, are found in close association with the mounds) are diminutive as compared with the latter, is inclined to ascribe the phenomenon, like Prof. Branner, to a chemical cause, due to the action of ground-water; the limited geographic distribution being perhaps a result of climatic conditions.

Levelling across the United States.—Dr. J. F. Hayford has called attention (*Science*, April 28, 1905) to the recent meeting at Hunt's junction, in Washington, of two lines of levelling carried out by the United States Coast and Geodetic Survey from the east and west respectively, the first connection by precise levelling between the Atlantic and Pacific being thus completed. The discrepancy at the junction was only 0·615 foot, and the question of a possible difference in level between the two oceans is not set at rest, the amount of the discrepancy (which places the Pacific at an apparently higher level than the Gulf of Mexico and the Atlantic) being possibly due to errors either in the tidal observations or in the levelling operations, or both. The extremely small discrepancy observed is well within the possible limits of error of the precise levelling alone, being only about two and half times the *probable* error. The operations were carried out with remarkable speed, the average rate of progress during the period 1900–1904 being 64 miles per month—giving a total of 3900 miles. In a subsequent number of *Science* (June 2, 1905), Mr. E. H. Williams points out the discrepancies which may arise, even within a few years, owing to vertical movements of the Earth's crust.

The Indians of the Santa Barbara Islands, California.—In the beginning of last year Dr. G. Eisen contributed to the Royal Bohemian Society of Sciences at Prague a paper dealing with the early inhabitants of the Santa Barbara islands, in which he embodied the results of his visits in 1873 and 1897. A reprint of this paper has recently been published in London by Messrs. A. Owen & Co., and is a useful summary of information on a little-known and now extinct race of Indians. The Santa Barbara islands lie off the coast of California, outside the Santa Barbara channel, and consist of two groups of four islands each. A central ridge runs along the whole group, varying in height between 800 and 2200 feet. Both as regards climate and productions, the islands were well suited to support a native population. They were at one time thickly populated with Indians, who have been extinct since 1853. The two southern islands of the group were discovered by Juan Rodriguez Cabrillo, in 1542, and in 1602 Sebastian Viscaino landed on the island of Catalina, and afterwards made a chart of his discoveries. The San Franciscan missionaries, who settled in California in 1769, also contributed to our knowledge of the Indians, the narrative of Miguel Costansó, a member of one of the expeditions, being of special interest. The Indians of the Santa Barbara islands appear to have been a finer race than those further north, and were of a peaceful nature, but cunning thieves. Their language was apparently largely related to the "Chumash" spoken by the Indians on the mainland of Santa Barbara country. The sites of the Indian villages were generally close to the shore and in proximity to fresh water. These are now represented by shell-heaps, which are numerous on all the islands, and vary in size, the largest one seen by the author being about 300 feet long by 50 feet wide, and about 10 feet high. They disclose a number of skeletons and utensils of various kinds; implements and ornaments have also been found. In discussing the question of the extinction of the island Indians, Dr. Eisen considers that they were largely exterminated by white settlers, such as otter hunters, sheep owners, and others, and by diseases introduced by white men, while their changed mode of life after the advent of the missionaries is referred to as a most important point in connection with the subject.

Mining in British Columbia.—The report for 1904 of the Minister of Mines for British Columbia shows that year's mineral output to have reached a value of $18,977,359 (over $100 per capita for the entire population of the province), an amount exceeded only in 1901. Of the minerals produced in 1904, the most valuable were lode gold, amounting to $4,589,608, and coal, $3,760,884. The coal output of 1904 was exceeded by that of each of the years 1899–1902; 1904, however, shows a greatly increased output of ore, amounting to nearly 1½ million tons—nearly 14 per cent. over that of 1903. Placer and lode gold being assigned to different categories, this year, for the first time in the history of the province, the total product of the coal-mines from their first opening takes the first rank among the items of the total mineral production to date, amounting (coal and coke) to $68,274,893 against $66,803,403 of placer gold, and $31,451,956 lode gold. The amount of gold produced from all sources is, however, greater than that of any other mineral, amounting to $89,255,359. The mineral production of British Columbia for 1904 ($18,977,359) exceeded that of all other provinces of the Dominion combined ($18,565,381). The collieries are situated in Vancouver island and on the western slope of the Rockies, near Crow's Nest pass in the extreme south-east of the province. The Vancouver island collieries mined 1,023,013 tons of coal during the year, besides 19,371 tons of coke. Of the Vancouver island coal about 53 per cent. went to California. The Crow's Nest pass collieries mined 662,685 tons of coal, of which 118,188 tons were exported to the United States. The export of coke has increased from 27,758 tons in 1903 to 97,690 tons in 1904. The report includes an account of the mining status of each district, and is furnished with illustrations of mining places and operations.

The Ecuador Degree-measurement.—The latest report to the Academy of Sciences, by the French Committee controlling the scientific operations for the degree-measurement in Ecuador (*C.R.*, vol. **140**, p. 998), shows that the difficulties with which the observers have had to contend have shown no signs of lessening during the year under review, and that, as a result, the completion of the undertaking must once again be subject to an unforeseen delay. As in former years, the meteorological conditions have proved persistently adverse, the amount of fog prevailing in the upper region of the Andes rendering long sojourns at many of the stations necessary. Besides this, the presence of bubonic plague in Ecuador has further hampered operations, while several of the officers in charge have been invalided through fever and other illnesses. After summarizing the operations actually carried out in 1904, the report discusses the steps to be taken in view of the unexpected retardation of the work. In order to keep within the limits of the funds at present available, it would be necessary to curtail the operations in four different ways, viz. by shortening the length of the arc; substituting a less precise method for the measurement of the southern base; omitting the pendulum observations; and giving up the extension to Machala on the coast. The reporter points out the grave defects by which the results would be impaired if these curtailments of the original plan were decided on, one important requirement—viz. the testing of the possible effect on the form of the geoid exercised by the attraction of the Andes—being thereby left unfulfilled. It is therefore urged that the idea of such an abbreviation should not be entertained, but that every effort should be made to carry out the undertaking in its entirety. It is thought that, even allowing for continued causes of delay, the whole should be completed by May, 1906.

AUSTRALASIA AND PACIFIC ISLANDS.

Captain Barclay's Exploration in Central Australia.—An expedition under Captain Barclay and Mr. Macpherson has lately traversed some hitherto unknown country to the north of Lake Eyre, the main objects being (1) to explore the country and endeavour to find a stock-route from Mandoora to Queensland; (2) to make a survey of a square mile of sandhill country for scientific purposes; (3) to search for possible traces of Leichardt and his companions. The explorers undertook the journey at their own expense, though the use of six camels was granted by the Government. Captain Barclay, who lately gave an account of his trip before the South Australian branch of the R.G.S. of Australasia, described the country traversed as hopeless, lifeless desert, the only vegetation being spinifex. It was a dreary journey, with water scarce and scanty, and for eight days nothing but sandhills were seen on either side. A visit was paid to the splendid Anacoola bore, which has a discharge of 700,000 gallons per day, but such is the thirsty nature of the sand that the greater part is at once sucked up. It is a singular fact that bulrushes at once spring up round these artesian bores, though they may not previously have existed anywhere in the vicinity. Rabbits were found to have infested the country in the neighbourhood of Todd river during the last few years, and proved useful for food. Going east, the explorers struck across to the Hale river, but in pushing further east fell into difficulties for want of water, and were forced to beat a retreat under a shade temperature of 114°. Many good photographs were taken, and the sandhill survey above alluded to was made, but in other respects the result of the journey was not encouraging, and, needless to say, no trace of the long-lost explorer was met with.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Ideal Topographical Map.—The following remarks were made by Mr. E. G. Ravenstein during the discussion on Major Close's paper on the above subject (*Journal*, vol. 25, p. 633 *et seq.*). Mr. Ravenstein said he had listened to the paper with pleasure. Much of what he should have liked to say had been said already. He thought it waste of money to spend a hundred pounds upon a specimen map. Specimen maps of all kinds might be had for a few shillings, and he thought that a collection of such maps, carefully selected, and representing all styles and scales, would prove both interesting and instructive. Among the maps now exhibited he missed some of the finest maps produced abroad. Some twenty years ago a committee of the British Association, of which Generals Walker and Lefroy, Lord Kelvin, and others were members, and himself secretary, laid down certain propositions for producing a physical map of the British Islands on a scale of 1: 200,000. The sheets of the map were to be bounded by meridians and parallels, the features of the ground were to be shown by contours and fathom-lines referred to the datum level of the Ordnance Survey, as explained by him in a paper placed before the Society in 1886,* and since carried out by the Ordnance Survey. Up to 600 feet and down to 100 fathoms these contours were to be drawn at intervals of 100 feet, and in special cases even at smaller intervals. The intervals between the contours were to be tinted. Various schemes of colouring, varying with the nature of the ground, were proposed, and in one case the colours of the prism were employed with good effect. Specimen maps, prepared by him, were to have been published, but, the expense proving too great, the intention was abandoned, and the specimens drawn by him had gone astray. When he

* See *Proceedings*, *R.G.S.*, 1886, pp. 21-27.

suggested the execution of such a map to a publisher, he was promptly met with the objection that a physical map would not sell. He had succeeded, however, in securing the acceptance of a modified scheme for a map of England, and four sheets of that map had been shown at the Geographical Congress in 1895, and were now exhibited on a screen in the room. Private publishers, who were bound to look for a profit, had not only to compete with public departments, like the Ordnance Survey Office, with whom profit was quite a secondary consideration; they had likewise to reckon with the want of appreciation of good maps on the part of the public. The public needed educating in the use of maps. He had never seen a cabman with a map, and if a dispute about a fare were brought before a Police-magistrate, the latter did not call for a sixpenny plan to measure the distance, but ordered two men out with a perambulator to measure the distance on the ground. Eventually the complainant or defendant had to bear the expense of this absurd proceeding, an expense which, in most cases, they might have avoided had they themselves consulted a map. He thought Mr. Freshfield would agree with him when he asserted that foreign tourists readily paid five shillings for a good map, whereas English tourists grudged the payment of sixpence. He thought classes or educational lectures on the use of maps, to which magistrates, cabmen, and other ignorant persons could be invited, might be organized with advantage. Once the public had been taught to appreciate good maps, the inferior article which now flooded the country would become unsaleable.

OBITUARY.

William Thomas Blanford, C.I.E., LL.D., F.R.S.

No name is perhaps more intimately connected with scientific progress in India during the last fifty years than that of Blanford—a name which future geologists, geographers, and naturalists will ever revere as they go over ground first studied by the two brothers, or when extending their researches among families of the rich and interesting fauna of our Indian Empire. Henry Blanford's loss we had to deplore some years ago (in 1893), now it is our sad duty to record that of the talented elder brother, William. Both men had a similar training at the School of Mines, Jermyn Street; both owe their scientific path through life, as they were proud to say, to a very clever mother, who fostered their early tastes for natural history, and led them to select the profession they afterwards filled so worthily. After a training under such masters as De la Beche, Lyon Playfair, Edward Forbes, Ramsay, and Warington Smyth, it is not surprising that William Blanford (who must now be more particularly referred to) went out to India in 1855, for duty on the Geological Survey under Dr. Thomas Oldham, with a mind well equipped for the work before him, with a broad, deep insight into geology, and a power of thought which enabled him to grasp and unravel the geological structure of peninsular India, at that time quite unknown. The publications of the Indian Geological Survey bear witness to the vast amount of this work, how well it was done, and how many years were devoted to it. After this splendid training in the field, next followed his appointment, in 1867, as geologist with the Abyssinian expedition to Magdala. It was a most fortunate selection, and the results were of great value. In 1872 he was again on special duty with the Boundary Commission in Persia, under Major St. John, R.E., where the geology and natural history as usual were excellently done. William Blanford's accomplishments did not end with geology. His love of natural history led him from the first to collect assiduously in many branches; thus, while his survey duties took him through the jungles of Southern India, the deserts of Sind, or the forests of Sikkim, mammals, birds, reptiles, and land mollusca all came under his keen observation, and were largely collected, so that his mind was a perfect store-house concerning their distribution, their habits, and specific differences. It was owing to this that there is so much that rivets attention in many of his writings, that blending of the geological past with the present world. The distribution of species was his strong point, shown in such papers as the "African Element in the Fauna of India," and many others. Dr. Blanford's most important work, in concert with H. B. Medlicott of the Geological Survey, was, no doubt, the 'Manual of the Geology of India,' which is a monument to both, and particularly to Blanford, who had the largest share in its preparation. It treats of the whole known parts of India, both Peninsular, the Himalayas, Assam, Burmah, etc., compiled from every available source, and brought up to date, a standard work from which all future investigation starts. To quote Prof. Henry Woodward: "His work in every department, whether in zoology, geography, or geology, has been marked by thoroughness, and accuracy," and the major part of it has stood the test of time.

Shortly after the appearance of the 'Manual,' he was compelled by ill health to resign the service of the Indian Government, but, on returning to a less trying climate, was, fortunately, able to commence another career as lengthy and important as the one in India.

From the first Blanford's tastes had led him more towards zoology than geology, and on his retirement this bent became more marked. At his suggestion, the Government of India undertook the publication of a comprehensive account of the fauna of British India, the whole of which was edited by him, and to which he contributed the volume on the mammalia and two volumes on birds. The principal part of his energies during the last five and twenty years of his life was, however, devoted to the service and administration of the scientific societies in which he was interested. As a member of the Royal Geographical Society his services to geography were of the highest order, and for years he was a frequent speaker at the evening meetings—his remarks having a special value as the result of a sound knowledge of the subject on hand. Most frequently these remarks entered the domain of physical geography, with which few men living were better able to deal. It is hardly necessary to add that he served on the Council for years, and became one of the Vice-Presidents. As president of the Geological, vice-president of the Royal and Zoological Societies, as treasurer and councillor of these and other societies, and as the trusted adviser of the Indian Office on matters connected with the sciences of which he was a master, his services were as valuable, and perhaps as lasting in their results, as his published works, and have ever been cordially recognized by his fellow-workers.

Space will not permit an enumeration of the many addresses and papers—some 175 in all—published by Blanford, but special mention must be made of his works on the geology and zoology of Abyssinia, and on the zoology and geology of Persia—still standard works on the countries they deal with. Particularly valuable from the geographical standpoint are his often-quoted description of the deserts of eastern Persia and his account of the origin of their surface features; while many of his geological papers contributed greatly to a knowledge of the physical geography of India. Thus his paper on the Indian desert, published by the Asiatic Society of Bengal in 1876, is a model of geographical research from the physical side. But for details of his life and writings, readers of the *Journal* may be referred to an excellent memoir written by Prof. Henry Woodward for the *Geological Magazine* of January, 1905.

For several years past his time had been principally occupied in editing 'The Fauna of India.' Besides compiling the volumes on the mammalia and birds, already referred to, he had begun work on the first volume of the land mollusca, and it may truly be said he died in harness. Even so recently as June 7 and 8 he was occupied with correspondence on this subject; then came the short illness, and he passed away on June 23, science losing one of her best and ablest sons. There is no doubt the hours he spent going over proofs of the 'Fauna' was a severe strain at his age; it kept him in when he should have been taking exercise out-of-doors. It had been evident to his many friends that his health was failing, yet he always picked up after a few days in the country, which shows that if he had not worked so hard his life would have been longer. Blanford was elected a Fellow of the Royal Society in 1874. Among other honours, he received the Wollaston Medal of the Geological Society and a Royal Medal of the Royal Society, and for his Indian services he was only quite recently made a Companion of the Order of the Indian Empire.

Blanford possessed a charm of manner not often met with: quiet and unassuming, ready to impart his knowledge to all, interesting and leading others to follow his footsteps in the studies he had made his own.

Colonel Sir John Farquharson, K.C.B.

We deeply regret to have to record the death of Colonel Sir John Farquharson, K.C.B., late Director-General of the Ordnance Survey, which occurred in Edinburgh early in July, at the comparatively early age of sixty-six years.

John Cosmo Macpherson was born on March 18, 1839, and was educated at Marischal College, Aberdeen, and at the Royal Military Academy, Woolwich. He obtained his first commission in the Royal Engineers on June 22, 1859. He joined the Ordnance Survey on July 1, 1872, and served on it as a Division officer till December 6, 1878, during which period he obtained a very intimate knowledge of the field work of the Survey, especially in the Highlands of Scotland. He rejoined the Ordnance Survey on September 1, 1882. In 1885 he served as Commissioner on the Boundary Commission in connection with the Redistribution Bill of that year.

In November, 1887, Lieut.-Colonel Macpherson was appointed Executive Officer of the Ordnance Survey, and held that post till his appointment as Director-General in March, 1894. In 1888 he was permitted to assume the name of John Farquharson.

Colonel J. Farquharson was retired from the army in 1896, on attaining the age of fifty-seven, being at the time a substantive colonel; but in view of the value of his services he was retained in his post as Director-General and Officer commanding the Survey companies till 1899. He was made a C.B. in 1890, for work in connection with the completion of the Cadastral Survey, and in 1899 he was made a K.C.B., on vacating the post of Director-General of the Ordnance Survey. Last year he was appointed to serve on a committee on the Survey of India, and threw himself into the work with his accustomed energy and thoroughness. On his return last May, his friends were distressed to see how ill he was. He never recovered, and died in Edinburgh on July 3.

Sir John Farquharson was a man of great ability, force of character, and energy. The prevailing characteristic of his work was thoroughness. He would probably have made his mark in any line of life. He wrote ably on military subjects, and, if he had had the good fortune to see active service, would probably have made a reputation as a soldier; but it was as one of the ablest of the heads of the Ordnance Survey that he is best known. It was during his tenure of office that the revision of the Ordnance Survey was started. The revision entailed a drastic change in the arrangements of the Survey, and many important questions had to be settled. His intimate knowledge of the work, his industry and thoroughness and sound judgment, enabled him to carry through the requisite changes smoothly and well. During his time increased attention was paid to the small-scale maps of the Ordnance Survey, which had for some years suffered owing to the pressure for the completion of the large-scale maps; and it is to him we owe the one-inch coloured map, which many consider one of the best of the Ordnance Survey maps.

Sir John Farquharson was a fellow of the R.G.S., and served for some years on the Council. He always maintained a keen interest in the work of the Society.

DUNCAN A. JOHNSTON.

Sir Augustus Charles Gregory, K.C.M.G.

One of the last remaining representatives of the early generation of Australian explorers, whose venturesome pioneer journeys did so much to reveal the general features of the interior of the continent during the middle decades of the last century, has passed away in the person of Sir Augustus Gregory, one of the three brothers who all did their part in making known to the world the districts lying behind the coast settlements of Western and Northern Australia. Sir Augustus was one of the best type of British explorers, combining qualities which eminently fitted him for the arduous tasks which he undertook, with a singular modesty and simplicity of character, which led him never to magnify his achievements or push himself forward as a claimant for public notice, however much those who knew him best might recognize the sterling quality of his work.

It is now close upon sixty years since Augustus Gregory first came forward as a pioneer in the opening up of the back country of Western Australia, where, though born in this country, the greater part of his early life had been spent. His father, Captain Joshua Gregory, of the 78th Highlanders (Rossshire Buffs) had been wounded at El Hamed, in Egypt, and forced to retire from active service, receiving in lieu of pension a large grant of land in the new settlement on the Swan river. Thither he went out, with his wife and five sons, in June, 1829, taking passage in the second passenger ship that ever sailed to that remote corner of the British dominions. Augustus, who had been born in 1819, in Nottinghamshire, was the second son, the two brothers who afterwards joined him in his first expedition—Francis and Henry—coming third and fourth in order. It was at quite an early age that the natural bent for surveying, which was afterwards developed to such good purpose, manifested itself in the laying down the boundary of the family property, which adjoined that of the surveyor-general. There was naturally much work of the kind to be done, and Gregory soon obtained employment in the survey department under the Imperial Government, gaining invaluable experience during five years spent in this service. The first real exploring work was done in 1846, when, having applied for leave of absence for the purpose of making an attempt to penetrate the difficult interior country which had baffled so many of his predecessors, Gregory obtained official sanction for his venture, in which he was joined by the two brothers above mentioned. Pushing on through the most inhospitable country, the brothers for the first time reached the borders of the Coolgardie district, noting that the geological formation was such as to lead to the expectation that gold might occur. The first West Australian coal was also found in the bed of the Irwin river.

Two years later Gregory led a party (sometimes known as the "Settlers' Expedition") for the purpose of searching for new districts suitable for stock in the north of the colony. The difficulties were no slight ones, as the prospectors were accompanied by their animals, while water was often scarce. Some good grazing country was, however, discovered. Later in the same year (1848) Gregory accompanied Governor Fitzgerald on a visit to the Geraldine lead-mine, and by his conduct during a brush with the natives (in which the governor was wounded) made a most favourable impression on the latter, which helped him in his future work. In 1854, when the idea of an exploration of the northern interior was engaging the attention of the home authorities, Gregory was specially named by the Duke of Newcastle, then Secretary for the Colonies, for the command of the party. The expedition, which set out in 1855, was the most important which he carried out, and will always be remembered as the first to shed light on the geography of the previously unknown interior of the northern territory. Starting from the mouth of the Victoria river, the party ascended this river to its source, crossing the watershed to the southward-flowing Sturt creek, and then making its way to the Gulf of Carpentaria, and across the northern peninsula to the east coast, shedding much new light on the rivers of this region, and discovering the water-parting formed by the Newcastle ranges. For his achievements on this expedition, Gregory received, in 1857, the Founder's Medal of the R.G.S.

Shortly after this Gregory was placed in charge of the Leichardt search expedition, which started from New South Wales, and followed down the Barcoo into Cooper's Creek, finally emerging at Adelaide just when anxiety was beginning to be felt for the safety of his party. On his return he took a prominent part in defining the southern boundary of Queensland, then just separated from New South Wales, and became Surveyor-General for the new colony, a post which he held for twenty years. The remainder of his career was connected with this colony, under whose government he held various posts, earning the respect and affection of all with whom he came in contact. He took a keen interest in scientific work of all kinds, and in 1895 held office as President of the Australian Association for the Advancement of Science, devoting his opening address to a sketch of the geological and geographical history of Australia. He was made K.C.M.G. in 1903.

Hermann von Wissmann.

On Friday, June 16, there died at his estate of Weissenbach, near Liezen in Styria, in consequence of a gun accident whilst out deer-stalking, Major von Wissmann, one of the most famed pioneer-explorers of tropical Africa.

Wissmann was born at Frankfurt on the Oder on September 4, 1853, the son of a Government official. He chose a military career. Having attended the school for cadets at Berlin, in 1871 he joined the 90th Fusiliers, and, after a further course of instruction at the military college at Anklam, was granted a commission as officer in January, 1874.

At Rostock, where his regiment was stationed, he became acquainted with Dr. Paul Pogge, and when the German African Association decided to send an expedition into inner Africa under the leadership of that experienced African traveller, in 1880, Wissmann was selected to be his companion. The expedition left Loanda in January, 1881, crossed the Kwango and the upper Kasai, and reached Nyangwe on the upper Congo on April 16, 1882. Dr. Pogge then turned back to the west,* but Wissmann went forward to the east, crossed the Tanganyika

* He died at Loanda, March 17, 1884.

to Ujiji, made his first acquaintance with Tipo Tib, the Arab slave-dealer, at Tabora, and reached Saadani, on the east coast, on November 15, 1882, the first German who had crossed tropical Africa from coast to coast.*

The success achieved attracted the attention of the King of the Belgians, at whose instance Wissmann undertook the conduct of an expedition, the main object of which was the exploration of the Kasai. Accompanied by Dr. L. Wolf, Lieut. Curt von François, and five other Europeans, among whom was a ship's carpenter, Wissmann left Hamburg on November 16, 1883, and proceeded by way of Loanda and Malanje, to the country of the Bashilange, where he founded the station of Luluaburg. Ten boats having been built there, the expedition started on May 28, traced the Kasai to its confluence with the Congo, and on July 16, 1885, arrived at Leopoldville, where it met with a hearty reception at the hands of Sir Francis de Winton, the governor of the Congo State.†

After a few months' rest in the congenial climate of Madeira, necessitated by the state of his health, Wissmann returned to the Congo in January, 1886, reached Luluaburg by way of the Kasai, left that place on November 16 with Lieut. Paul le Marinel and a caravan of 900 men, and once more arrived at Nyangwe on February 15, 1887. It was his intention to work his way northward towards the region occupied by Emin Pasha, but the disturbed state of the country, and the hostile attitude of the Arabs, who detained him for three months, compelled him to abandon this plan, and to travel to the east coast by way of Tanganyika, the Stevenson road, and the Shire. On August 8, 1887, he arrived at Kilimani, and when he passed through Zanzibar, homeward bound, he "gave himself up entirely to joy at the successful results of the German spirit of enterprise."‡

Wissmann spent the winter of 1887–88 at Madeira. Meantime the Royal Geographical Society awarded him the Patron's Medal "in recognition of his great achievements as an explorer of Central Africa, and especially for the arduous and adventurous journey in which he traced the river Kasai from its upper waters to its previously unknown junction with the Congo."§

On June 25, 1888, during a visit to England, he read a paper before our Society, "On the Influence of Arab Traders in Western Central Africa."‖ At that time he was full of ardour to continue his work in Africa in the service of science and civilization, and he told the writer of this obituary that he intended to throw up his commission in the Prussian army, as after the stirring life he had led it would be impossible for him to submit to the drudgery of drilling recruits from year's end to year's end.

This resolution he never carried out, for soon after his return to Germany he was induced to associate himself with Dr. Carl Peters for the alleged purpose of bringing relief to Emin Pasha.¶ Fortunately for his reputation, he retired from this enterprise when, on February 8, 1889, Prince Bismarck, who highly valued his abilities, appointed him Imperial Commissioner, and allotted him the task

* 'Unter deutscher Flagge quer durch Afrika.' Berlin: 1888.

† 'Im Innern Afrikas: die Erforschung des Kassai. Von Wissmann, Wolf, François, u. Mueller.' Leipzig: 1888.

‡ 'Meine zweite Durchquerung Aequatorial-Afrikas, 1886–7.' Frankfurt a. d. O.: 1898. An English translation of this work appeared in 1891, under the title of 'My Second Journey through Equatorial Africa.'

§ *Proceedings of the Royal Geographical Society*, 10, 1888, pp. 300, 467, 537.

‖ Ibid., p. 325.

¶ Dr. Peters, in spite of the blockade of the coast, managed to land his expedition at Kwyho on June 15, 1889.

of quelling an insurrection, headed by the Arabs, which had broken out in August, 1888, immediately the officials of the German East African Company attempted to take possession of the coast-line conceded to it by the Sultan of Zanzibar. Wissmann set about this task with his accustomed energy and discretion. When he arrived at Zanzibar on March 31, 1889, the only coast towns still held by the Germans were Bagamoyo and Dar es Salam. Backed by a native force of about a thousand Sudanese and other natives commanded by German officers and non-commissioned officers, and supported by the navy, he reoccupied Saadani and Pangani in June and Tanga in July. He then reopened the caravan route to Mpwapwa, and on September 9 reoccupied that station, at which Stanley and Emin, coming from the interior, arrived on November 10. On December 4, Bushiri, the cruel leader of the rebellion, fell into his hands, and was executed, whilst Bwana Heri, next to Bushiri the most important leader of the Arabs, voluntarily surrendered on April 3, 1890. Having thus recovered possession of the whole northern section of the protectorate, Wissmann in the course of May recovered Kilwa and the other southern ports, and on the 26th of the month left Zanzibar for Europe. At Berlin he met with a most enthusiastic reception. The Emperor, in recognition of the great services rendered by him to the cause of German colonization, ennobled him, and promoted him to the rank of major, whilst the University of Rostock conferred upon him the honorary degree of D.Ph. After spending several months with his aged mother at Lauterberg, in the Harz, he once more returned to Africa in November. In the year following he led a punitive expedition against Sina of Kibosho, on Kilimanjaro. On April 1, 1891, the term for which he had been appointed expired, but it was hoped that he would have been appointed "governor" of the colony which had so much benefited by his activity; but this was not to be. His friend Bismarck was no longer in office, and General Caprivi appointed in his stead, first Baron Soden, during whose rule, in August, 1891, a German military force was annihilated by the Wahehe; and secondly, Baron Schele. Wissmann, taking no heed of the slight put upon him, continued in the colonial service in a subordinate position. Having, some years before, pointed out to the German Anti-slavery Committee that the most effective way of stopping the slave trade consisted in building inland stations and placing steamers upon the lakes, he undertook to convey a steamer, provided by a public subscription, to one of these. Originally intended for the Victoria Nyanza, it ultimately found its way to Lake Nyasa. Whilst Captain Prager was busy at Mpimbi piecing together the steamer, Wissmann went north, founded the station of Langenburg, and cleared the country between Nyasa and Tanganyika of slave-hunters. The steamer was launched on January 12, 1893, and, having been fitted with engines at Port Maguire, arrived at Langenburg on September 21, and has been doing excellent service ever since. Wissmann's health having broken down, he left Africa once more in December.*

The last act in Wissmann's African life opened in May, 1895, with his appointment as Governor of German East Africa. When he landed at Dar es Salam on July 24, he was acclaimed as a friend by natives and Arabs, whilst the military and naval authorities, who had received his predecessors with much ostentation, stood strangely aloof. On assuming office, he declared that he should do his utmost to develop the natural resources of the colony, to raise the natives to a

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* There are at present three German steamers on the lakes, viz. the *Hermann Wissmann* on Lake Nyasa; an aluminium steam-pinnace on the Victoria Nyanza, since April, 1900; and the *Hedwig von Wissmann* on Tanganyika, since the spring of 1901.

higher plane of civilization, and to promote scientific research; bureaucratic methods would be discarded. It is worth noting that Wissmann did not believe in the colonization of tropical Africa by agricultural colonists, but thought that native labour under European supervision would yield satisfactory results. Having held this honourable office for little more than a year, Wissmann, owing to the state of his health, finally retired from public life. He was only rarely heard of since, and spent the remainder of his days at an estate which he had bought in Styria, and there he died, leaving a widow and four children to mourn his loss.

Wissmann was of a genial, cheerful disposition, candid and outspoken, generous, and at all times ready to recognize the merits even of his rivals. In the management of public affairs he showed much judgment, and never abused the power with which he was entrusted. In dealing with the natives he was ever conciliatory and accessible, and thus won their good-will and even love. Unfortunately, his constitution was none of the strongest; his health broke down repeatedly, and he was ultimately compelled to retire altogether from public life.

E. G. R.

Alexander Begg.

Mr. Alexander Begg, well known in British Columbia as a successful journalist and writer, as well as for his interest in crofter immigration, died in New York in March last, leaving a widow and eleven children. Mr. Begg was born in Caithnessshire in 1825, and went to Canada in 1846, eventually becoming inspector of inland revenue for the north-west. He also acted as emigration commissioner to Scotland for the Ontario Government. Mr. Begg was the author of a useful 'History of British Columbia.'

CORRESPONDENCE.

The Yun-nan Railway.

In the discussion which took place after Colonel Manifold's paper on the Upper Yangtze Provinces, given in the June number of the *Geographical Journal*, Sir George Scott made some criticisms on the way the preliminary reconnaissance for the Yun-nan railway was carried out. Time did not admit of a reply being made at the moment, so I hope you will allow me to answer his remarks here.

In the first place, Sir George Scott rather hints that the work was not carried out by properly qualified railway engineers. The survey party sent out by the Yun-nan Company included the late Captain W. A. Watts-Jones and Captain C. G. W. Hunter, both officers of the Royal Engineers who had made a special study of railways, and had had previous experience of reconnoitring for a line through difficult country.

Sir George Scott then represents both Captain Watts-Jones and myself as being in such a hurry to get to Ta-li Fu that we followed each other blindly along the same road, looking neither to the right nor to the left. As a matter of fact, we surveyed between us four or five different roads to Ta-li Fu, but we certainly did not start out with any fixed idea that the railway must pass through that place, for our proposed main line does not go to Ta-li Fu at all.

Sir George Scott then gives his views as to the direction that the line ought to take. He suggests that we did not pay sufficient attention to the country lying east of the Nam Ting valley. I think, however, that a glance at the Survey of India sheets * on 4 miles to an inch, which give the results of our work, will show that this part of the country is particularly well filled in, while the more westerly part of it has, in addition, been triangulated and accurately surveyed by the Boundary Commission.

The line which he proposes is to "cross southwards from the Nam Ting to the Nam Hsung." This is not very intelligible, for the Nam Hsung lies *east* of the lower course of the Nam Ting. I can only suppose that he means to follow the Nam Ting up to about lat. 23° 45′ or higher, and then bend round southward, passing perhaps near Keng-ma (lat. 23° 32′, long. 99° 27′), and reaching the Nam Hsung at Möng-Hsung (lat. 23° 20′, long. 99° 30′). The range which divides the Nam Ting from the Nam Hsung has been crossed by our routes in three places, and has nowhere been found as low as 7000 feet. As the Nam Ting valley is here not much over 2000 feet, the difficulties of getting a railway from one valley to the other are likely to be considerable.

Even if this obstacle could be overcome, it is by no means to be taken for granted that by the Nam Hsung valley "the Mekong could be easily approached." The Nam Hsung throughout its course runs between steep hills, and railway construction down its banks is likely to be extremely difficult, for in Yun-nan the valleys of the big rivers, bounded as they are by steep hillsides very liable to slips, were found on the whole to be the worst lines for a railway to follow.

Having reached the Mekong, Sir George Scott proposes to take the line to Ching-tung Ting (lat. 24° 25′, long. 100° 55′), but he omits to mention that this place is not in the valley of the Mekong, but in that of the Black river, and that between these two valleys flows yet another river, the Wei-yuan Chiang, with ranges of hills 7000 to 8000 feet high on each side of it. If to avoid crossing these two ranges we take the line up the Mekong and round the source of the Wei-yuan Chiang, we are confronted first with the difficulties of construction up the steep-sided Mekong valley for more than 100 miles, and then with a range of hills between the Mekong and the Black river, marked with the height of 11,500 feet. Doubtless there are lower places in it than this, but as the Mekong is here at an elevation of only 3100 feet, and the Black river at 3850 feet, this range between them is likely to prove an insurmountable obstacle.

Even if a railway could be got to Ching-tung Ting, the difficulties are by no means over. Sir George Scott says that from here "there is no difficulty whatever in going north towards Ta-li Fu." One would imagine, from this description, that the line would lead up a level plain. So far from this being the case, there is a pass of 6800 feet between the valley of the Black river and that of the Red river in which lies Meng-hua Ting (lat. 25° 15′, long. 100° 23′), and another pass of 8800 feet between the Meng-hua Ting plain and the Ta-li Fu plain.

Another line from Ching-tung Ting that Sir George suggests is "to a point halfway between Ta-li and Yun-nan Fu." By this he probably means Yun-nan Hsien (lat. 25° 30′, long. 100° 35′). But this place is not in the valley of the Black river, but in that of the Red river, so that yet another high range of hills has to be crossed to reach it.

From here he goes on to say, "there is an easy approach to the Yangtze." It is quite true that a practicable line for a railway could probably be found from

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* The sheets which include this part of the country are: South-East Frontier Series, Sheets 4 N.E., 12 N.W.; North-East Frontier Series, Sheets 30 S.W., 31 N.W., 31 S.W. These are in the Society's Map Room.

Yun-nan Hsien, reaching the Yangtze near Chin-chiang-kai (lat. 26° 15′, long. 100° 40′). But it would be quite a mistake to suppose that in reaching the river here the object of the line would be accomplished. To make the terminus of the railway at this out-of-the-way spot, where the river is not navigable for boats, would be quite useless. It might be supposed from the map that it would be easy to carry the line down the Yangtze valley, but such is far from being the case. Nearly the whole course of this part of the river is through steep gorges, and no place of any importance is passed through till Sui Fu is reached, some 500 miles below. These 500 miles of extremely difficult construction through an absolutely unprofitable country would render such a line quite impracticable.

To compare with Sir George Scott's proposals, I will give shortly the line reconnoitred by Captain Watts-Jones as far as Yun-nan Hsien. It would follow up the Nam Ting from Kun-long, continuing northwards over a range (5600 feet) to Yun Chou (lat. 24° 25′, long. 100° 10′). From here down the Nan-chiao Ho to the Mekong, up this river for 30 miles, and then by an easy ascent up a small side stream past Kung-lang (lat. 24° 50′, long. 100° 20′) and over another watershed (7200 feet) to the Red river valley. Both the Black river and the Wei-yuan Chiang are avoided altogether by going round their sources.

Our reconnaissance of 1000 miles of railway was, owing to limits of time, necessarily imperfect, and criticism of it *based on further surveys of the country* would be most welcome. I am not rash enough to pronounce Sir George Scott's line impossible, but I do not think that he is justified in brushing on one side the work of the Yun-nan Company survey parties and describing his line as "the proper route."

The maps to which I have referred are sold by the Survey of India in Calcutta, but appear to be difficult to obtain in England. Probably Sir George Scott has not come across them, but I venture to think that if he can find time to study them, he will convince himself that the line he suggests is not such a simple matter as he supposes.

H. R. Davies, Major,
Oxfordshire Light Infantry.

London, June 13, 1905.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1904–1905.

Sixteenth Meeting, June 26, 1905.—Right Hon. Sir George T. Goldie, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

Elections:—*John Cecil Macrae (Indian Army, 43rd Erinpura Regt.); Lieut.-Colonel C. F. Minchin, D.S.O. (Indian Army); Maurice Hart Orr-Ewing; Lieut. A. S. Redman, R.E.; Charles Atmore Sherring; Reginald Campbell Thompson, M.A.; Sidney A. Tippetts, B.A.; John Claus Voss.*

The paper read was:—

"The French Antarctic Expedition." By Dr. Charcot.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Abh. = Abhandlungen.	Mem. (Mém.) = Memoirs, Mémoires.
Ann. = Annals, Annales, Annalen.	Met. (mét.) = Meteorological, etc.
B. = Bulletin, Bollettino, Boletim.	P. = Proceedings.
Col. = Colonies.	R. = Royal.
Com. = Commerce.	Rev. (Riv.) = Review, Revue, Rivista.
C. R. = Comptes Rendus.	S. = Society, Société, Selskab.
E. = Erdkunde.	Sc. = Science(s).
G. = Geography, Géographie, Geografia.	Sitzb. = Sitzungsbericht.
Ges. = Gesellschaft.	T. = Transactions.
I. = Institute, Institution.	Ts. = Tijdschrift, Tidskrift.
Iz. = Izvestiya.	V. = Verein.
J. = Journal.	Verh. = Verhandlungen.
Jb. = Jahrbuch.	W. = Wissenschaft, and compounds.
k. u. k. = kaiserlich und königlich.	Z. = Zeitschrift.
M. = Mitteilungen.	Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Greece. **Baedeker.**
Greece. Handbook for Travellers, by K. Baedeker. Third edition. Leipzig: K. Baedeker; London: Dulau & Co. 1905. Size 6½ × 4½, pp. cxxxiv. and 434. *Maps, Plans, and Panorama. Price 8m. Two copies, presented by the Publishers.*

Italy—Bibliography. *Riv. G. Italiana* 11 (1904): pp. 90. **Magistris.**
Bibliografia geografica della regione Italiana. Anno III. 1903. Rassegna di L. F. de Magistris.

Italy—Garda Lake. *Atti R.A. Lincei, Rendiconti* 14 (1) (1905): 90–92. **Teglio.**
Le sesse nel lago di Garda. Nota preliminare dell dott. E. Teglio.

Italy—Vesuvius. *C. Rd.* 140 (1905): 200–202. **Janssen.**
Sur une récente ascension au Vésuve. Note de J. Janssen.

Mediterranean—Cyprus. **Hutchinson and Cobham.**
A Handbook of Cyprus. Compiled by Sir J. T. Hutchinson and C. D. Cobham, C.M.G., 1905. London: E. Stanford, 1905. Size 7½ × 5, pp. xii. and 126. *Maps and Frontispiece. Price 2s. 6d. net. Presented by the Publisher.*

Norway. **Nansen.**
Norway and the Union with Sweden. By F. Nansen. London: Macmillan & Co., 1905. Size 7½ × 5, pp. vi. and 96. *Price 2s. net. Presented by the Publishers.*

A useful sketch of the history of the relations between Norway and Sweden.

Norway. *Z. Ges. Erdk. Berlin* (1905): 5–19. **Ebeling.**
Die Ergebnisse einer Studienreiser im Gebiet des Jostedalsbrae. Von Dr. M. Ebeling. *With Map and Illustrations.*

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Société des Sciences de Finlande. État des glaces et des neiges en Finlande pendant l'hiver 1893–1894 exposé par A. Heinrichs. Helsingfors, 1904. Size 13½ × 10½, pp. 60. *Maps.*

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Russia—Ural. *C. Rd.* 140 (1905): 333–335. **Duparc and Pearce.**
Sur l'existence de hautes terrasses dans l'Oural du Nord. Note de L. Duparc et F. Pearce.

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La cartographie de l'Espagne. Par le Lieut.-Colonel F. Prudent.

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Zur Siedelungsgeographie Schwedens. Von Prof. Dr. R. Sieger.

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Norrlandskartan och Rikets allmänna Kartverk. Af E. Melander. *With Index Map.*

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Le Simplon et la défense commerciale de Marseille. Par Ct. H. Lambin.

Turkey. **Gelzer.**
Vom Heiligen Berge und aus Makedonien. Reisebilder aus den Athosklöstern und dem Insurrektionsgebiet. Von H. Gelzer. Leipzig: B. G. Teubner, 1904. Size 8 × 5½, pp. xii. and 262. *Map and Illustrations. Presented by the Publisher.*

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The most valuable work on the subject that has appeared, and of much interest to the student of human geography.

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Sixteenth-Century Maps of Ireland. By R. Dunlop.

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United Kingdom—Scotland. **Clough and Harker.**
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See note, *ante*, p. 208.

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Explorations in Turkestan, with an account of the Basin of Eastern Persia and Sistan. Expedition of 1903, under the Direction of R. Pumpelly. Washington: Carnegie Institution, 1905. Size 12 × 9½, pp. xii. and 324. *Maps and Illustrations. Presented by the Carnegie Institution of Washington.* [To be reviewed.]

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Eastern Asia. **Ireland.**
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Includes a geographical chapter and others on the inhabitants, the political organization, etc., etc.

Malay Archipelago—Java. **Kern.**
Bijd. Taal-, Land- en Volkenk. Ned.-Indië 4 (1905): 364–367.
Iabadioe. Door H. Kern.

Explanation of the form "Iabadiu" of Ptolemy, and variants of the same name.

Malay Archipelago—Saparua. ———
Ts. K. Ned. Aard. Genoots. Amsterdam 22 (1905): 374–376.
Bij de Kaart van Saparoea. Door *Red. With Map.*

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Malay Archipelago—Sumatra. **Helb.**
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De Topographische opneming en Kaarteering van Zuid-Sumatra. Door H. Helb.

Persia. *Petermanns M.* 51 (1905): 4–12, 31–35. **Stahl.**
Reisen in Zentral- und Westpersien. Von A. F. Stahl. *With Maps.*

Russia—Caucasus. **Hoffmann.**
Die deutschen Kolonien in Transkaukasien. Von P. Hoffmann. Berlin: D. Reimer (E. Vohsen), 1905. Size 9½ × 6½, pp. x. and 292. *Maps and Portrait. Price* 6*s.*

The author, who is an agricultural expert, made a special study of the German colonies in the Caucasus during two visits to that region, as forming the part of the community which has made the most advance in agriculture. He gives interesting details respecting the history of the German emigration, which took place originally from Württemberg, early in the nineteenth century, from motives connected with religion.

Siam. ———
Siam. General Report on the Operations of the Royal Survey Department, Season 1902–1903. Bangkok, 1904. Size 13½ × 8½, pp. 62. *Maps, Plans, and Illustrations. Presented by the Royal Survey Department, Bangkok.*

Turkey. *B.S.G. Com. Paris* 27 (1905): 49–57. **Favette.**
Voies régionales de la Turquie d'Asie. Débouché occidental du Transasiatique russe. Par D. Favette.

Turkey—Palestine. **Lees.**
Village Life in Palestine. A description of the religion, home life, manners, customs, characteristics, and superstitions of the peasants of the Holy Land, with reference to the Bible. By the Rev. G. Robinson Lees. New edition. London: Longmans & Co., 1905. Size 8 × 5½, pp. x. and 236. *Illustrations. Price* 3*s.* 6*d. net. Presented by the Publishers.*

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Africa—Railways. **Renty.**

Les Chemins de Fer coloniaux en Afrique. Troisième partie. Chemins de Fer dans les Colonies Françaises. Par E. de Renty. Paris: F. R. de Rudeval, 1905. Size 7½ × 5, pp. xii. and 496. *Maps. Price 5 fr. Presented by the Publisher.*

The most complete account of French African railway undertakings that has yet appeared.

British East Africa. **Linton and Brand.**

Africa. No. 2 (1905). Report on the possibilities of Cotton-growing in the East Africa Protectorate for 1904. London: Wyman & Sons, 1905. Size 13½ × 8½, pp. 18. *Price 2½d.*

Cape Colony—Geology. **Rogers.**

An Introduction to the Geology of Cape Colony. By A. W. Rogers. With a Chapter on the Fossil Reptiles of the Karroo Formation by Prof. R. Broom, M.D. London: Longmans & Co., 1905. Size 8 × 5½, pp. xviii. and 464. *Map and Illustrations. Price 9s. net. Presented by the Publishers.* [To be reviewed.]

Central Africa. **Fisher.**

On the Borders of Pigmy Land. By Ruth B. Fisher. London: Marshall Bros. [1905]. Size 9 × 6, pp. x. and 216. *Illustrations. Price 3s. 6d. net. Presented by the Publishers.* [See p. 212, *ante.*]

East Africa. ——

Handbook for East Africa, Uganda, and Zanzibar, 1905. Mombasa. Size 7½ × 5, pp. 256. *Map. Presented by the Editor.*

Kamerun. *M. Deutsch. Schutzgeb.* **16** (1903): 245–252. **Moisel.**

Begleitworte zu der Karte "Der mittlere Teil von Kamerun zwischen Sanaga und dem 8. Grade nördlicher Breite." Von M. Moisel. *Map.*

The map (scale 1 : 1,000,000) is based on a number of hitherto unpublished surveys.

Kamerun. *Deutsch. Kolonialblatt* **16** (1905): 81–88, 115–119. **Stieber.**

Bericht des Hauptmanns und Residenten von Kusseri, Stieber, über seine Reise in das Gebiet der Musgus.

Cf. note in Monthly Record for May (p. 567).

Madagascar. *Rev. Madagascar* **3** (1901): 457–472. ——

La route de l'Ouest et la mission du Capitaine Mauriès. Par M.R.S.

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Les Tribus Musulmanes du Sud-Est de Madagascar. Par G. Ferrand.

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André You. Madagascar. Histoire, Organisation, Colonisation. Préface de M. Albert Decrais. Introduction de M. le Général Gallieni. Paris and Nancy: Berger-Levrault et Cie., 1905. Size 9 × 6, pp. xvi. and 636. *Map. Price 10s.*

A useful compendium of information.

Madagascar and Reunion. *C. Rd.* **140** (1905): 639-642. **Driencourt.**

Sur la détermination par transport de temps des différences de longitude à Madagascar et à la Réunion. Note de M. Driencourt.

Morocco. *C. Rd.* **140** (1905): 395–397. **Brives.**

Sur les terrains éocènes dans le Maroc occidental. Note de A. Brives.

Morocco. *Renseign. Col., Com. l'Afrique Française* (1905): 92–100. **Brives.**

Aperçu géologique et agricole sur le Maroc occidental. Par A. Brives. *With Map.*

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Sur la constitution du Djebel Hadid (Maroc occidental). Note de P. Lemoine.

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Sur une coupe géologique du Haut-Atlas, dans la région du Glaoui (Maroc). Note de P. Lemoine.

Morocco. *Archiv. Marocaines* **2** (No. II.) (1904): pp. 228. **Michaux-Bellaire and Salmon.**

El-Oçar el-Kebir: Une ville de province au Maroc Septentrional. Par E. Michaux-Bellaire et G. Salmon. *With Map and Illustrations.*

Nile. *Globus* **87** (1905): 69-72. **Herrmann.**

Die letzten Fragen des Nilquellenproblems. Von Hauptmann a. D. Herrmann. *With Map. Also separate copy.*

Nile. *J.S. Arts* 53 (1905): 274–284. **Preece.**

The Navigation of the Nile. By Sir W. H. Preece, K.C.B., F.R.S. *With Map.*

North and West Africa. **Marin.**

Algérie, Sahara, Soudan. Vie, Travaux, Voyages de Mgr. Hacquard des Pères Blancs (1860–1901) d'après sa correspondance. Par l'Abbé Marin. Avec une Préface du Commandant Hourst. Paris & Nancy: Berger-Levrault et Cie., 1905. Size 10 × 6½, pp. xviii. and 646. *Maps and Illustrations. Price* 15*s.*

Narrative of extensive travels in North and West Africa, including a voyage down the Niger.

Portuguese East Africa. ———

The Delagoa Directory for 1905. A Year Book of Local Information regarding the Port and Town of Lourenço Marques. Lourenço Marques: A. W. Bayly & Co. Size 8½ × 5½, pp. 132. *Map.*

Sahara. *Renseign. Col., Com. l'Afrique Française* (1905): 37–63. **Laperrine and Nieger.**

Une tournée dans le sud de l'annexe du Tidikelt, du 4 mars au 30 juillet 1904. Rapport du commandant Laperrine, avec un levé d'itinéraire par le lieutenant Nieger. *Map and Illustrations.*

South Africa. **Corstorphine.**

The History of Stratigraphical Investigation in South Africa. By G. S. Corstorphine. (Reprinted from the Report of the South African Association for the Advancement of Science, Johannesburg Meeting, 1904.) Size 9½ × 6½, pp. 145–182. *Presented by the Author.*

South Africa. **Hutchinson.**

From the Cape to the Zambesi. By G. T. Hutchinson. With an Introduction by Colonel F. Rhodes, C.B. London: J. Murray, 1905. Size 8½ × 6, pp. xiv. and 206. *Illustrations. Price* 9*s. net. Presented by the Publisher.*

Interesting as presenting the impressions, in regard to South Africa and its possibilities, of a visitor who has approached the question with unbiassed mind, and is evidently possessed of considerable powers of observation.

South Africa—Barotseland. **Harding.**

In Remotest Barotseland. Being an Account of a Journey of over 8000 miles through the wildest and remotest parts of Lewanika's Empire. By Colonel C. Harding, C.M.G. London: Hurst & Blackett, 1905. Size 9 × 6, pp. xvi. and 414. *Map and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

To be reviewed.

Sudan. *La G., B.S.G. Paris* 11 (1905): 1–6. **Lapparent.**

Sur de nouvelles trouvailles géologiques au Soudan. Par A. de Lapparent. *With Illustrations.*

West Africa. *Meteorolog. Z.* 22 (1905): 120–127. **Hann.**

Zum Klima der äquatorialen Westküste Afrikas. Von J. Hann.

West Africa. *Rev. G.* 29 (1905): 52–56. **Olivier.**

La délimitation de la frontière Niger-Tchad. Par E. Olivier. *With Map and Illustrations.*

Zanzibar. **Lyne.**

Zanzibar in Contemporary Times. A Short History of the Southern East in the Nineteenth Century. By R. N. Lyne. London: Hurst & Blackett, 1905. Size 9 × 5½, pp. xii. and 328. *Maps and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

See note at p. 212, *ante*.

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Canada. **Fraser.**

Canada as it is. By J. J. Fraser. London: Cassell & Co., 1905. Size 8 × 5½, pp. viii. and 304. *Illustrations. Price* 6*s. Presented by the Publishers.*

A good popular account of Canadian life, industries, and resources, with forecasts of the future of the Dominion.

Mexico—Historical. **Lamprey.**

Selections from Prescott's History of the Conquest of Mexico. Edited by A. S. Lamprey. London: H. Marshall & Son, 1905. Size 7½ × 5, pp. 148. *Maps and Illustrations. Price* 1*s.* 3*d. Presented by the Publishers.*

North America—Historical. **Biedma and Bourne.**
Narratives of the career of Hernando De Soto in the Conquest of Florida, as told by a Knight of Elvas, and in a Relation by Luys Hernandez de Biedma, Factor of the Expedition. Translated by Buckingham Smith. Together with an account of De Soto's Expedition, based on the Diary of Rodrigo Ranjel, his private secretary. Translated from Obiedo's 'Historia General y Natural de las Indias.' Edited with an Introduction by E. G. Bourne. 2 vols. London: D. Nutt, 1905. Size 7 × 4½, pp. (vol. 1) xxviii. and 224; (vol. 2) 192. *Map and Portrait. Price 7s. 6d. net. Presented by the Publisher.* [To be reviewed.]

North America—Historical. **Dawson.**
The Saint Lawrence Basin and its border-lands, being the Story of their Discovery, Exploration, and Occupation. By S. E. Dawson. London: Lawrence & Bullen, 1905. Size 9 × 6, pp. xl. and 452. *Maps and Illustrations. Price 7s. 6d. Presented by the Publishers.* [To be reviewed.]

North America—Historical. **Lewis and Clarke, and McMaster.**
History of the Expedition under the Command of Captains Lewis and Clark to the Sources of the Missouri, thence across the Rocky Mountains and down the River Columbia to the Pacific Ocean, performed during the years 1804–5–6, by order of the Government of the United States. A complete reprint of the Biddle Edition of 1814, to which all the members of the expedition contributed. With an account of the Louisiana Purchase. By Prof. J. B. McMaster, and notes upon the route. 3 vols. London: D. Nutt, 1905. Size 7½ × 4½, pp. (vol. 1) xxii. and 416; (vol. 2) viii. and 410; (vol. 3) viii. and 382. *Maps and Portraits. Price 10s. 6d. net. Presented by the Publisher.* [To be reviewed.]

United States. *B. American G.S.* **37** (1905): 1–14. **Blanchard.**
The United States Reclamation Service. By C. J. Blanchard. *With Map and Illustration.*

United States. *J. Geology* **12** (1904): 415–469, 617–660. **Peet.**
Glacial and Post-Glacial History of the Hudson and Champlain Valleys. By C. E. Peet. *With Maps and Illustrations.*

United States—California. **Baldwin.**
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Triangulation in California. Part i. By A. L. Baldwin. *With Maps.*

United States—Floods. **Brandenburg, Alexander, and Sloan.**
Monthly Weather Rev. **32** (1904): 465–468.
September Floods in the South-west. The flood in south-eastern Colorado. F. M. Brandenburg. Recent floods in the Rio Grande Valley. W. H. Alexander. The great floods of September in New Mexico. J. B. Sloan.

United States—Historical. **Hulbert.**
Historic Highways of America. Vols. **13** and **14**, The Great American Canals; vol. **15**, The Future of Road-making in America; vol. **16**, Index. By A. B. Hulbert. Cleveland, Ohio: The Arthur H. Clark Co., 1904–5. Size 8 × 5½, pp. (vol. **13**) 232; (vol. **14**) 234; (vol. **15**) 212; (vol. **16**) 188. *Maps and Illustrations.*

The series is now completed, and forms an interesting summary of the history of communications in the United States.

United States—Immigration. *National G. Mag.* **16** (1905): 1–27. **McSweeny.**
The character of our Immigration, Past and Present. By Z. F. McSweeny. *With Diagram.*
Our Immigration in 1904. *With Illustrations and Diagrams.*

United States—Irrigation. *U.S. Census, B.* 16 (1904): pp. 92. **Blanchard.**
Irrigation in the United States: 1902.

United States Levelling. **Hayford.**
Rep. U.S. Coast and Geodetic Surv. (1904), *Appendix* 6: 401–430.
Precise Leveling from Red Desert, Wyoming, to Owynee, Idaho, 1903. By J. F. Hayford.

United States—Meteorology. *Monthly Weather Rev.* **32** (1904): 556–559. **Kimball.**
Evaporation Observations in the United States. By H. H. Kimball. *Map.*

United States—New Mexico. *Science* **21** (1905): 90–97. **Macbride.**
The Alamogordo Desert. By Prof. T. H. Macbride.

United States—Texas. **Hayford.**
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Precise Leveling from Holland to New Braunfels, Texas, 1903. By J. F. Hayford.

CENTRAL AND SOUTH AMERICA.

Andes. *G.Z.* **11** (1905): 39–51. **Steffen.**
Neue Forschungen in den Chilenisch-argentinischen Hochkordilleren. Von Dr. H. Steffen. *Map.*

Argentine Republic. **Urien and Colombo.**
Geografía Argentina. Estudio histórico, físico, político, social y económico de la República Argentina. Por C. M. Urien y E. Colombo. Buenos Aires, 1905. Size 11 × 7½, pp. xxxii. and 688. *Maps. Presented by Sr. Carlos M. Urien.* [To be reviewed.]

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Ethiopia in Exile. Jamaica revisited. By B. Pullen-Burry. London: T. Fisher Unwin, 1905. Size 8 × 5, pp. 288. *Price 6s. Presented by the Publisher.*

Paraguay. **Azara and Schuller.**
Anales del Museo Nacional de Montevideo. Sección histórico-filosófica. Tomo i. Geografia física y esférica de las Provincias del Paraguay, y Misiones Guaraníes. Compuesta por Don F. de Azara. Bibliografia, Prólogo y Anotaciones, por R. R. Schuller. Montevideo, 1904. Size 10 × 7½, pp. cxxxii. and 478. *Facsimile Maps and Plates. Presented by the Museo Nacional, Montevideo.*
Printed for the first time from the manuscript of the well-known naturalist.

AUSTRALASIA AND PACIFIC ISLANDS.

New Caledonia. *Oester. Monats. Orient* **31** (1905): 13–18. **O'Carrol.**
Neu-Kaledonien. Von O. Freiherrn v. Hoennig O'Carrol.

Pacific Ocean. *American J. Sci.* **19** (1905): 143–148. **Agassiz.**
On the Progress of the *Albatross* Expedition to the Eastern Pacific. By A. Agassiz. (See also *Science* **21** (1905): 178–183.)

Queensland. **Petrie.**
Tom Petrie's Reminiscences of Early Queensland. (Dating from 1837.) Recorded by his Daughter. Brisbane: Watson, Ferguson & Co.; London: J. Gray & Son. 1904. Size 8½ × 6, pp. xvi. and 320. *Plan and Illustrations. Presented by Messrs. J. Gray & Son.*
See note at p. 213, *ante.*

South Australia. **Basedow.**
T. and P. and Rep. R.S. South Australia **28** (1904): 12–51.
Anthropological Notes made on the South Australian Government North-West Prospecting Expedition, 1903. By A. Basedow. *With Plates.*

South Australia—Meteorology. **Todd.**
Meteorological Observations made at the Adelaide Observatory, and other places in South Australia and the Northern Territory during the years 1900–1901, under the direction of C. Todd, K.C.M.G., etc. Adelaide, 1904. Size 13½ × 8½, pp. xx., 188, and 168. *Maps. Presented by the Agent-General for South Australia.*

Tobi Island. *Globus* **87** (1904): 113–117. **Seidel.**
Die Bewohner der Tobi-Insel (Deutsch-Westmikronesien). Von H. Seidel.

Victoria. *P.R.S. Victoria* **17** (1905): 366–370. **Hart.**
Note on the Stony Creek Basin, Daylesford. By T. S. Hart. *With Plates.*

POLAR REGIONS.

Arctic—Nansen Expedition. **Nansen and Mohn.**
The Norwegian North Polar Expedition, 1893–96. Scientific Results. Edited by Fridtjof Nansen. Vol. 6. London: Longmans & Co., 1905. Size 12 × 9½, pp. xiv. and 660. *Diagrams. Presented by the Fridtjof Nansen Fund.*
Embraces the meteorological results worked up by Prof. Mohn.

MATHEMATICAL GEOGRAPHY.

Surveying. *C. Rd.* **140** (1905): 302–305. **Driencourt.**
Sur la précision de positions géographiques obtenues en cours de voyage avec l'astrolabe à prisme. Note de M. Driencourt.

Surveying. *C. Rd.* **140** (1905): 413–417. **Laussedat.**
Sur une carte topographique d'une assez grande étendue levée en très peu de temps à l'aide de la Photographie. Note de A. Laussedat.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology. **Geikie.**
Structural and Field Geology for Students of Pure and Applied Science. By James Geikie, LL.D., etc. Edinburgh: Oliver & Boyd, 1905. Size 9 × 6, pp. xx. and 436. *Illustrations. Price 12s. 6d. net. Presented by the Publishers.*

Geophysics. *Ciel et Terre* **25** (1905): 553–561; **26** (1905): 6–18. **Becker.**
Les problèmes actuels de la Géophysique. Par G. F. Becker.

Geophysics. *C. Rd.* **140** (1905): 899–901. **Leduc.**
Sur la marche de la solidification de la Terre. Note de A. Leduc.

Glaciation. *C. Rd.* **140** (1905): 397–399. **Girardin.**
Sur la relation des phénomènes erratiques avec le modelé des hautes vallées glaciaires. Note de P. Girardin.

Glaciers. *G. Anzeiger* **6** (1905): 1–3, 25–27. **Machaček.**
Zum gegenwärtigen Stande der Gletscherkunde. Von Dr. F. Machaček.

Hydrology—Whirlpools. *Le Globe, Mém. S.G. Genève* **43** (1904): 95–134. **Brunhes.**
Nouvelles observations sur le rôle et l'action des Tourbillons, par J. Brunhes. Avec deux appendices, par S. Squinabol et G. Dal Piaz. *With Plates.*

Limnology—Seiches. *Petermanns M.* 50 (1904): 294–295. **Endrös.**
Seiches kleiner Wasserbecken. Von Dr. A. Endrös.

Meteorology. **Jelinek.**
Jelinek's Anleitung zur Ausführung meteorologischer Beobachtungen nebst einer Sammlung von Hilfstafeln. Fünfte Auflage. Erster Teil. Anleitung zur Ausführung meteorologischer Beobachtungen an Stationen I. bis IV. Ordnung. Wien, 1905. Size 10½ × 7, pp. x. and 127. *Illustrations. Presented by the K.K. Zentral-Anstalt für Meteorologie.*

Meteorology—Halo. **Leyst.**
Die Halophänomene in Russland. Von Prof. Dr. E. Leyst. Moscow, 1903. Size 10½ × 7, pp. 136. *Diagram. Presented by the Observatoire Météorologique, etc., de l'Université Impériale de Moscou.*

Meteorology—Refraction. *Meteorolog. Z.* **22** (1905): 49–63. **Maurer.**
Beobachtungen über die irdische Strahlenbrechung bei typischen Formen der Luftdruckverteilung. Von J. Maurer.

Oceanography. **Bjerrum.**
Meddelelser Kom. Havundersøgelser, Ser. Hydrog. 1 (Nr. 3) (1904): pp. 12.
On the determination of Chlorine in Sea-water, and examination of the accuracy with which Knudsen's pipette measures a volume of Sea-water. By N. Bjerrum.

Oceanography. *P.R.I.* **17** (1905): 357–374. **Buchanan.**
Historical Remarks on some Problems and Methods of Oceanic Research. By J. Y. Buchanan, F.R.S.

Oceanography. **Hansen.**
Meddelelser Kom. Havundersøgelser, Ser. Hydrog. 1 (Nr. 2) (1904): pp. 10.
Experimental determination of the relation between the Freezing-point of Sea-water and its specific gravity at 0° C. By H. J. Hansen.

Oceanography. *Petermanns M.* **51** (1905): 1–4, 25–31. **Nansen.**
Die Ursachen der Meeresströmungen. Von Prof. Dr. F. Nansen.

Physical Geography—Terms. *J. Geology* **12** (1904): 707–715. **Salisbury.**
Three New Physiographic Terms. By R. D. Salisbury. *With Maps and Illustration.*

The terms proposed are "topographic unconformity," "topographic adjustment" (of streams, in contrast to "structural" adjustment), and "superimposed youth" (such as may result from glacial deposition).

Ripple-mark. *P.R.S.* 74 (1905): 565–566. **Ayrton.**
The Origin and Growth of Ripple-mark. By Mrs. H. Ayrton. (Abstract.)

Sand. *Deutsch. Rundschau G.* 27 (1905): 241–247. **Neuber.**
Der Sand des Strandes und Seine Herkunft. Von A. Neuber.

Springs. *C. Rd.* 140 (1905): 382–384. **Houllier.**
Sur la cause de l'appauvrissement des sources dans les régions de plaines. Note de M. Houllier.

Tides. *Rep. U.S. Coast and Geodetic Surv.*, 1904, Appendix 5 (1904): 313–400. **Harris.**
Manual of Tides. Part iv. B. Co-tidal lines of the World. By R. A. Harris. *With Maps.*

Volcanoes. *La G., B.S.G. Paris* 11 (1905): 7–26. **Boule.**
La Montagne Pelée et les volcans d'Auvergne. Par M. Boule. *With Map and Illustrations.*

Zoogeography—Bird Migrations. *Naturw. Wochenschrift* 4 (1905): 113–120. **Koepert.**
Die Ankunft unserer Zugvögel in ihrer Abhängigkeit von der Phänologie ihrer Nahrungstiere und deren Nahrungspflanzen. Von Dr. Koepert.
Noticed in the Monthly Record (July number, p. 92).

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. **Mucke.**
Das Problem der Völkerverwandtschaft. Von Dr. J. R. Mucke. Greifswald: J. Abel, 1905. Size 9½ × 6½, pp. xxiv. and 368. *Price 7s. 6d. net.*

This is the third of a series of works by the same author, dealing with the influence of environment on the evolution of primitive societies. Dr. Mucke's ideas are in many ways not calculated to meet with acceptance among ethnologists, but the facts and suggestions here brought together may be of some use to those interested in the subject.

Historical—Pytheas. **Callegari.**
G. V. Callegari. Pitea di Massilea. (Estratto dalla *Rivista di Storia Antica*, Anno vii. 4; vii. 2; ix. 2.) Feltre, 1904. Size 10 × 6½, pp. 88. *Presented by the Author.*

The author shows a wide acquaintance with the literature of the subject, but his conclusions differ in many ways from those of previous writers. They are also frequently at variance with those of Herr Detlefsen (*Journal*, vol. 25, p. 673), whose memoir had not appeared when the present paper was written.

Language-Study. **Madan.**
An Outline Dictionary intended as an aid in the study of the languages of the Bantu (African) and other uncivilized races. Edited by A. C. Madan. London, etc.: H. Frowde, 1905. Size 7 × 4½, pp. xv. and 400. *Presented by the British South Africa Company.*

English words and phrases suitably arranged, with blank spaces for the filling in of native equivalents, or notes on their method of use. The book should be decidedly useful to travellers among tribes whose languages are little known.

BIOGRAPHY.

Plehn. *Deutsch. Kolonialzeitung* 21 (1904): 373–374. **Ziemann.**
Prof. Dr. Friedrich Plehn. Von H. Ziemann. *Portrait.*

The late Dr. Plehn was well known as a pioneer in West Africa, especially for his services to tropical pathology.

Ratzel. *G. Anzeiger* 5 (1904): 243–247. **Achelis.**
Zum Gedächtnis Friedrich Ratzels. Von Prof. Th. Achelis.

Richter. *M. Deutsch. u. Österrich. Alpenr.* (1905): 29–31. **Penck.**
Eduard Richter. Von A. Penck.
Cf. obituary in the April *Journal* (p. 468).

Schlagintweit. *Deutsche Rundschau G.* 27 (1905): 182–183. ——
Dr. Emil Schlagintweit. *With Portrait.*

GENERAL.

Bibliography. *G. Teacher* 2 (1904): 264–268. **Herbertson.**
Recent Geographical Works. A list supplementary to that given in Dr. H. R. Mill's 'Hints to Teachers.' By A. J. Herbertson.

Congress. *Ann. G.* 14 (1905): 1–22. **Martonne.**
Le VIII.^e Congrès International de Géographie (Washington, 1904) et sa grande excursion dans l'ouest et au Mexique. Par E. de Martonne. *With Illustrations.*

Educational—Regional Geography. *G. Teacher* 2 (1904): 251–254. **Unstead.**
Regional Geography in Schools. By J. F. Unstead.

Urges the need of graduating the teaching of regional geography (in its side which deals with the interrelations of phenomena) according to the attainments of the pupils.

Educational—River Study. *G. Teacher* 2 (1904): 239–244. **Hubbard.**
A River Study. By G. D. Hubbard.

Discusses the study of rivers in general, and their influence on human activities.

Hydrographic Surveys. *National G. Mag.* 16 (1905): 63–67. **Littlehales.**
Marine Hydrographic Surveys of the Coasts of the World. By G. W. Littlehales. *With Maps.*

Miscellanea. **Ratzel.**
Glücksinseln und Träume. Gesammelte Aufsätze aus den Grenzboten. Von F. Ratzel. Leipzig: F. W. Grunow, 1905. Size 9 × 6, pp. vi. and 516. *Portrait. Price 7s.*

A volume of miscellaneous essays dealing largely with personal experiences, and abounding in philosophical reflections on men and things. A less personal item is a study of the German inn.

Phrase-book. **[Murray.]**
Handbook of Travel-talk, being a collection of questions, phrases, and vocabularies in English, French, German, and Italian. Intended to serve as Interpreter to English travellers abroad and Foreigners in England. 19th edition. London: E. Stanford, 1905. Size 5 × 3½, pp. 64 and 688. *Price 3s. 6d. Presented by the Publisher.*

This edition is thoroughly brought up to date by the inclusion of topics which have lately come to the fore.

Science and Metaphysics. **Lobley.**
Positive Knowledge. A Reply to the Cambridge Address of the Right Hon. A. J. Balfour, M.P., &c. By J. Logan Lobley. (Reprinted from the *Journal of the City of London College Science Society*, vol. 10, Nos. 2 and 3.) Launceston, [*not dated*]. Size 9 × 5½, pp. 22. *Presented by the Author.*

Sciences. *J. Geology* 12 (1904): 669–687. **Davis.**
The relations of the Earth Sciences in view of their progress in the Nineteenth Century. By W. M. Davis.

Travel. **Treves.**
The Other Side of the Lantern. An Account of a Commonplace Tour round the World. By Sir F. Treves, Bart. London: Cassell & Co., 1905. Size 9½ × 6½, pp. xvi. and 424. *Illustrations. Price 12s. net. Presented by the Publishers.*

One of the most striking of recent popular sketches of travel. Although the scenes are not new, the author's power of vivid description and pleasant style of writing lend them a new interest.

Turkish Empire. **Baedeker.**
Konstantinopel und das westliche Kleinasien. Handbuch für Reisende von K. Baedeker. Leipzig: K. Baedeker, 1905. Size 6¼ × 4½, pp. xxiv. and 276. *Maps and Plans. Price 6m. Presented by the Editor.*

The first issue of a new guide intended to supplement those previously published on Greece, Egypt, and Syria.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S

EUROPE.

Ægean Sea. **Grundy.**

Murray's Handy Classical Maps. Edited by G. B. Grundy, M.A. Mare Ægæum, etc. London: John Murray, [1905]. *Price 1s. net. Presented by the Publishers.*

There are the following maps and plans on this sheet: Ægean sea, Egypt, Propontis, Rome in the time of the Emperors, Rome during the Republic, Roma Quadrata, two small plans showing the areas covered by ancient and modern Rome, Athenæ, Piræeus, and Acropolis. The first three are small general maps, orographically coloured, and the latter nine plans on various scales. As is the case with others of this series, a useful index to place-names is also given.

Austria. **Rothaug and Umlauft.**

Schulwandkarte des Erzherzogtums Osterreich unter der Enns. Bearbeitet von Joh. Georg Rothaug. Für Mittelschulen bearbeitet von Prof. Dr. Friedrich Umlauft. Scale 1:150,000 or 2·4 stat. miles to an inch. Vienna: G. Freytag & Berndt, [1905]. *Price, mounted on linen, 20k. Presented by the Publishers.*

This is a wall map of Austria below the Enns, specially designed for the use of schools. The relief is shown first by a system of carefully drawn fine contour-lines, in brown, at intervals of 100 metres, which enable the student by a close examination to gain fairly accurate and detailed information concerning the mountain systems and configuration of the land; whilst superimposed upon these is bold shading which transforms the map into a diagram or wall-map, and brings only the leading features into prominence, so that they can be clearly distinguished from a distance. The shading is of the oblique illumination character, and an attempt has been made to follow the natural colours of the spectrum, the highest crests of the ranges and peaks being orange, the land of medium height yellow, and the lower lands a greenish blue and a blue-green. The general effect is decidedly pleasing and graphic, although the dark shading on the slopes away from the direction in which the light is supposed to fall is perhaps unnecessarily heavy. However, the contour-lines give the form of the land, and will help to prevent the student from being misled.

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from June 1 to 30, 1905.

2 miles to 1 inch:—

Printed in colours, folded in cover or flat in sheets, (26 and parts of 27, 33, 34), 44. *Price, on paper, 1s.; mounted on linen, 1s. 6d. each.*

1 inch:—

(Third edition), in outline, 17, 27, 313, 320. 1s. *each* (engraved).

(Third edition), with hills in brown or black, 16, 257. 1s. *each* (engraved).

(Third edition), printed in colours, folded in cover or flat in sheets, 257, 314. *Price, on paper, 1s.; mounted on linen, 1s. 6d. each.*

6-inch—County Maps (first revision):—

Devonshire, 7 N.W. **Gloucestershire**, 10 N.E. **Herefordshire**, 33 S.E., 37 S.E., 38 N.W., 40 N.E., 44 N.W., 51 S.W., 53 N.W. **Lincolnshire**, 122 N.E. **Somerset**, 6 N.W. **Suffolk**, 50 S.W. **Warwickshire**, 19 S.W. **Worcestershire**, 11 S.W., 20 S.W., 29 S.W., S.E., 53 N.E. 1s. *each.*

25-inch—County Maps (first revision):—

Cardiganshire, XIV. 14; XVI. 7, 12, 15, 16; XIX. 3, 4, 6, 8, 10, 12; XX. 2, 3, 4, 5, 6, 7, 9, 11, 14, 15, 16; XXI. 2, 4, 5, 6, 7, 9, 10, 11, 13, 14, 15; XXII. 1; XXVI. 2, 3, 4, 6, 7, 10, 11, 12; XXVII. 1, 2, 5, 6, 7. **Devonshire**, XVI. 9, 15, 16; XXIII. 3, 4, 7, 11, 12, 16; XXIV. 2, 3, 4, 6, 7, 8, 9, 10; XXV. 1, 5; XXX. 14; XXXVI. 5, 9, 10, 11, 12, 16; XLIII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XLIV. 1, 5, 9, 13; XLVII. 4, 8; XLVIII. 4, 7, 12; LIV. 1, 2, 3, 4, 5, 9; LXXVIII. 12, 14, 15, 16; XCII. 9. **Lincolnshire**, LXXXV. 1, 6, 10, 14; XCVI. 6, 9; XCVII. 2, 11, 12; XCVIII. 2, 3, 4, 6, 9, 13, 15, 16; XCIX. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; C. 6, 9, 13; CVIII. 3, 8, 16. **Norfolk**, LXVIII. 7, 8, 12, 15, 16; LXIX. 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16; LXXX. 7, 8; LXXXI. 2, 3, 4, 6, 7, 8, 11; LXXXII. 1, 2, 3, 4, 5, 7, 8, 10, 13, 14; LXXXIII. 1, 2, 3, 5, 6, 7, 9, 10, 11, 13, 14,

15; XCII. 1, 2; XCIII. 1, 2, 3; XCVI. 5, 6, 11; XCVIII. 15; XCIX. 5, 6, 7, 11; CVI. 1. **Suffolk**, VIII. 15; IX. 5, 6, 7, 11. **Warwickshire**, XXIV. 16; XXV. 13, 14, 15; XXVII. 14, 15; XXVIII. 13, 15; XXXI. 4, 8, 12; XXXII. 1, 2, 3, 5, 6, 7, 9, 10, 11; XXXIII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 16; XXXIV. 2, 3, 4, 6, 7, 8, 10, 11, 12; XXXV. 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12; XXXVII. 13, 14; XLIII. 14. **Yorkshire** (First Revision of 1891 Survey), CCLXXXIII. 13; CCLXXXVIII. 2; CCLXXXIX. 9. *3s. each.*
(*E. Stanford, London Agent.*)

Europe. **Koch.**

Eisenbahn- und Verkehrs- Atlas von Europa. Von Dr. W. Koch. Leipzig: J. J. Arnd, 1905.

In many respects this atlas resembles the railway atlas of Central Europe by Flemming and Merkel, which was noticed in the last number of the *Geographical Journal*, the principal difference being that, instead of being confined to Central Europe, it includes the whole of the continent, and, in addition, the trans-Siberian railway and a general communication map of the world. The maps vary considerably in the amount of information they contain, and are most irregular and unequal in their arrangement. For instance, there are twenty-six sheets devoted to Germany, four to Switzerland, and seven to France, but only the merest general outline on one sheet to the whole of the British Isles. The atlas is accompanied by tables of statistical information and a good index. A separate handbook to form a companion to the atlas is promised at the end of the year.

France. **Reclus.**

Carte des chemins de fer, routes, et voies navigables de la France, dressée sous la direction d'Onésime Reclus. Scale 1:1,000,000 or 15·8 stat. miles to an inch. Paris: Haar & Steinert, 1905.

A useful railway map of France, with enlarged inset plans of the environs of Paris, Marseilles, and Paris, and a plan of Corsica.

ASIA.

Asia, South-West. **Stanford.**

The Russo-Afghan Frontier. Scale 1:6,589,440 or 104 stat. miles to an inch. London: Edward Stanford, 1905. *Price* 2*s.* 6*d.*

A small general map of Central Asia extending from the Aral sea and Lake Balkash on the north to Peshawur on the south, and from the Caspian on the west to western Tibet on the east. The special feature of the map is that it shows garrison towns and fortified posts, which are distinguished from each other by different symbols, as well as railways proposed and constructed in red.

Asia, South-West. **Topographical Section, Caucasian Military Staff.**

Map of Caucasia, Asiatic Turkey, and Persia. Scale 1,680,000 or 26·5 stat. miles to an inch. 10 sheets. [In Russian.] Tiflis: Topographical Section, Caucasian Military Staff, 1903.

This is a general Russian map of Western Asia, extending from Asia Minor to the western frontier of Afghanistan, and from north of the Caspian to the Red sea and the coast of Baluchistan. It is printed in colours, and contains a considerable amount of detail and many place-names. The latter, however, are in certain districts somewhat confused through being printed upon the dark hill-shading.

China. **China Inland Mission.**

Map of China prepared for the China Inland Mission. Scale 1:3,168,000 or 50 stat. miles to an inch. 4 sheets. New edition. London: Edward Stanford, 1905. *Price* 8*s.*

Although specially prepared to show the stations of the China Inland Mission, which are underlined in red, and those of other Protestant missions, underlined in blue, this map has been found to be of considerable service for purposes of general reference, and this new edition will doubtless be welcomed. Some of the more important routes of explorers are shown, as well as railways working and proposed. The information given is, of course, of a very general character.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 4 miles to an inch. Sheets: 10 S.E., part of district Thar and Parkar (Sind, Bombay Presidency), additions to 1904. 13 N.E., parts of Baroda State and Kathiawar Agency (Bombay Presidency), additions to 1897, 1903. 13 S.E., parts of Baroda State and Kathiawar Agency (Bombay Presidency), additions to

1900, 1903. 22 N.W., parts of district Ahmedabad and Native States Baroda, Cutch, Kathiawar and Palanpur Agencies (Bombay Presidency), additions to 1898, 1903. 28 S.W., parts of districts Hazara (N.W.F. Province), Rawalpindi (Punjab), and of Kashmir State, additions to 1904. 28 S.E., part of Kashmir State (Punjab), additions to 1904. 31 N.E., parts of districts Ferozepore and Ludhiana and of Native States Patiala, Nabha, Faridkot, and Jind (Punjab), additions to 1902. 31 S.W., parts of district Ferozepore and Native States of Bahawalpur (Punjab) and Bikaner (Rajputana Agency), corrected to 1902. 32 N.W., parts of Bikaner Native State (Rajputana Agency), additions to 1902, 1904. 32 N.E., parts of district Hissar and Native States Loharu (Punjab) and Bikaner (Rajputana Agency), additions to 1904. 37 S.E., part of district Khandesh (Bombay Presidency), and of Native State Indore (C.I. Agency), additions to 1901, 1904. 38 S.W., parts of districts Nasik, Ahmednagar, Poona, and Thana (Bombay Presidency), and Aurangabad (Nizam's Dominions), corrections to 1902. 38 S.E., parts of districts Aurangabad and Bir (Nizam's Dominions), Ahmednagar, and Nasik (Bombay Presidency), additions to 1904. 41 S.E., parts of districts Dharwar, Belgaum, and Kanara, Kolhapur, and Southern Maratha and Dharwar Agencies (Bombay Presidency), and district Lingsugur (Nizam's Dominions), 1904. 47, parts of districts Ludhiana, Jullundur, Hoshiarpur, Kangra, Simla, and the Protected Hill States of Mandi, Bashahr, etc. (Punjab), and of district Dehra Dun and the Native State of Garhwal (United Provinces), additions to 1903. 48 N.W., parts of districts Umballa, Ludhiana, and Karnal, and of Patiala, Nabha, Jind, Maler Kotla, and Kalsia Native States (Punjab), additions to 1903. 48 S.E., parts of districts Dehra Dun, British Garhwal, Saharanpur, Muzaffarnagar, and Bijnor (United Provinces), Karnal and Umballa (Punjab), additions to 1902. 49 N.E., parts of districts Moradabad, Meerut, Muzaffarnagar, Bulandshahr, and Bijnor (U.P. of Agra and Oudh), Delhi, and Karnal (Punjab), additions to 1903. 50 S.W., parts of Bharatpur, Alwar, Karauli, and Jaipur States (Rajputana Agency), 1904. 61, parts of districts Malabar, Coimbatore, Madura, and Salem (Madras Presidency), and of district Mysore (Mysore Native State), and Coorg, addition to 1903. 66 N.W., parts of districts Garhwal and Dehra Dun and Tehri Garhwal State (United Provinces), additions to 1902. 66 N.E., parts of districts Almora and Garhwal (United Provinces), and Hundes (Tibet), and of Nepal, additions to 1900. 66 S.W., parts of districts Bijnor, Almora, Naini Tal, and Garhwal, and Tehri Garhwal State (United Provinces), additions to 1903. 66 S.E., parts of districts Naini Tal, Almora, and Garhwal (United Provinces), and of Nepal, additions to 1903. 67 N.W., parts of districts Moradabad, Bijnor, Bareilly, Naini Tal, and Rampur State (United Provinces), additions to 1901. 70 S.W., parts of districts Saugor and Damoh (Central Provinces), Jhansi (United Provinces), and of Native States Gwalior, Bhopal, and Panna (C.I. Agency), additions to 1903. 72 N.W., parts of districts Chindwara, Betul, Nagpur, Seoni, and Amraoti (Central Provinces), additions to 1902. 72 S.W., parts of districts Nagpur, Wardha, and Amraoti of Berar (Central Provinces), additions to 1904. 72 S.E., parts of districts Nagpur, Bhandara, Raipur, Balaghat, and Chanda (Central Provinces), additions to 1903. 78 S.E., parts of districts Chingleput, North Arcot, and South Arcot (Madras Presidency), 1904. 79 S.E., parts of districts Tanjore, Trichinopoly, and South Arcot (Madras Presidency), Karikal (French Territory), additions to 1900, 1904. 105 N.E., parts of districts Palamau, Ranchi, and Singhbhum, and of Jashpur State (Bengal), additions to 1904. 105 S.E., parts of districts Ranchi, Singhbhum, States Bonai, Gangpur, Jashpur, Keonjhar (Bengal), district Sambalpur, and State Bamra (Central Provinces), additions to 1903. 115, parts of districts Balasore, Cuttack, and Midnapore, and of Mayurbhanja, Keonjhar, Dhenkanal, Hindol, Bonai, Lahara, Tigiria, Athgar, Nilgiri, and Baramba Tributary States of Orissa (Bengal), additions to 1902. 116, parts of districts Cuttack, Puri, and Tributary States of Baramba, Nayagar, Ranpur, Tigiria, etc. (Bengal), additions to 1903. 119, district Bogra, and parts of districts Purnea, Dinajpur, Rangpur, Malda, Murshidabad, Rajshahi, and Mymensingh (Bengal), Goalpara and Garo Hills (Assam), additions to 1902. 121, district Howrah, and parts of districts 24 Parganas, Burdwan, Khulna, Nadia, Jessore, Faridpur, Backergunge, Midnapore, and Hooghly (Bengal), additions to 1903. 130 N.W., parts of districts Darrang, Sibsagar, Nowgong, Lakhimpur, Naga Hills (Assam), and Daphla Hills, additions to 1903. 130 S.W., parts of districts Nowgong, Cachar, Naga Hills, and Sibsagar, and Manipur State (Assam), additions to 1904.—Military map of India, 32 miles to an inch, corrected to 1903, 1904.—Western Bengal Survey, 8 miles to an inch. Sheets: 2, districts Shahabad, Saran, Gaya, Palamau, etc, additions to 1903. 7, districts Patna, Muzaffarpur, Darbhanga, Purnea, Bhagalpur, Monghyr, etc., and part of Nepal State, additions to 1903.—Province of Bengal, 16 miles to an inch; Third Edition, 1904.—Bengal District maps, 4 miles to an inch: Belasore, 1904; Muzaffarpur, 1904. 8 miles to an inch: Backergunge, 1903; Jessore, 1903; Rangpur, 1902; Monghyr, corrected to 1903, 1904.—Bengal Lower Provinces district maps, 4 miles to an inch: Hazaribagh, 1904; Nadia (Presidency Division), additions to 1904; Rangpur, additions to 1902, 1904.—Bombay District maps, 4 miles to an inch: Nasik, 1904; Satara, 1904.—Central Provinces District maps, 4 miles to an inch: Bhandara, 1904; Chanda, 1904; Chindwara, 1904; Narsinghpur, 1904; Sambalpur, 2 sheets, 1904; Saugor, 1904; Seoni, 1904.—Punjab District map, 4 miles to an inch: Shahpur, 1904.—United Provinces district maps, 4 miles to an inch: Kheri, 1904: Shahjahanpur, 1904. 8 miles to an inch: Banda, corrected to 1903; Hamirpur, corrected to 1903; Jhansi, corrected to 1902.—Assam District map, 4 miles to an inch: Nowgong, 1904.—North-Eastern Frontier Survey, 4 miles to an inch. Sheet: (Second Edition) 31 N.W., part of Yun-nan Province (China), Season 1899–1900, 1904.—South-Eastern Frontier Survey, 4 miles to an inch. Sheets: (Fourth Edition) 1 N.W., parts of districts Lushai Hills and Native States of Manipur (Assam), Hill Tippera and Chittagong Hill Tracts (Bengal), Chin Hills (Burma), Seasons 1853–66, 1871–72, 1888–94, additions to 1904, 1904; (Fifth Edition) 2 S.E., parts of districts Pakokku, Minbu, Myingian, Meiktila, Yamethin, Magwe, and Chin Hills, Seasons 1885–87, 89–91, and 1897, additions to 1902, 1904; (Fourth Edition) 3 N.E., portions of Minbu, Magwe, Yamethin, Thayetmyo, Prome, and Toungoo Districts, Seasons 1885–87, 1890–92, 1903; 12 S.W., S.E., China, Yun-nan Province, Season 1894–95, 1898–1900, 1902.—North-Western Trans-Frontier Survey, 8 miles to an inch. Sheets: (Second Edition) 22, parts of Afghanistan, Baluchistan, and Sind, 1903. 4 miles to an inch. Sheets (Fourth Edition) 29 S.W., part of Baluchistan and Punjab, Seasons 1883–88, 1894–97, 1904. 2 miles to an inch. Sheets: 423, part of Afghanistan, Season 1879–89, 1904; 424, parts of Afghanistan and the N.W.F. Province, Seasons 1879–80, 1894–95, 1904.—Assam Survey, 1 mile to an inch. Sheets: (Preliminary Edition) 17, districts Kamrup and Goalpara, Seasons 1893–95, 1896–97, 1904; (Preliminary Edition) 25, district Kamrup, Seasons 1883–86, 1896–97, 1904; (Preliminary Edition) 98, district Lakhimpur, Season 1891–92, 1899–1900, 1904; (Preliminary Edition) 99, districts Sibsagar and Lakhimpur, Seasons 1891–92, 1898–99, 1904.—Lower Provinces Revenue Survey, 1 mile to an inch. Sheet 14, district Purneah, 1901.—Bengal Survey, 1 mile to an inch. Sheets: 112, 114, districts Muzaffarpur and Saran, Seasons 1892–95, 1896–99, 1904; 141, districts Muzaffarpur and Darbhanga, Seasons 1894–96, 1899–1900, 1904; 168, district Puri, Seasons 1889–91, 1895–96, 1904; (Second Edition) 194, district Cuttack, Season 1890–92, 1894–95, 1904; (Preliminary Edition) 198, district Darbhanga, Seasons 1895–96, 1899–1900, 1904; (Second Edition) 286, district Hooghly, Howrah, Burdwan, 24 Parganas, and Nadia, Seasons 1849–57, 1869–72, 1903; (Second edition) 287, districts Howrah, Hooghly, and 24 Parganas, Seasons 1851–55, 1869–72, 1903; 315, district Jalpaiguri, Seasons 1890–91, 1892, 1903; 409, 420, district Chittagong, Seasons 1888–93, 1904.—Bombay Survey, 1 mile to an inch. Sheets: (Second Edition) 96, parts of districts Ahmedabad, Baroda State, and Kathiawar Agency, Seasons 1866–67, 1867–68, 1902; 196, districts Poona and Thana, Seasons 1877–78, 1879–80, 1902; 200, districts Poona, Satara, and Kolaba, and Poona Agency, Season 1875–76, 1901; 243, district Belgaum and Kolhapur, Savantvadi, Sangli and Kurundvad States, Season 1886–87, 1901; 279, district N. Kanara, Seasons 1890–92, 1896–97, 1903.—Burma, and Bengal Surveys, 1 mile to an inch. Sheets: 4 (Burma), 428 (Bengal), parts of districts Akyab (Burma) and Chittagong (Bengal), Seasons 1884–87, 1891–93, 1904.—Burma Survey, 1 mile to an inch. Sheets: (Preliminary Edition), 103, 104, 105, district Lower Chindwin, Seasons 1899–1902, 1904; 119 (N.S.) parts of districts Henzada, Prome, and Sandoway, Seasons 1898–1901, 1904; (Preliminary Edition) 146 (N.S.) district Shwebo, Seasons 1892–97, 1901; (Second Edition) 162 (N.S.) parts of districts Prome and Henzada, Seasons 1882–83, 1885–89, 1898–90, 1903; 200, parts of districts Myingyan, Magwe, Yamethin, and Meiktila, Seasons 1893–94, 1901–02, 1903; 202 (N.S.) parts of districts Yamethin and Magwe, Seasons 1893–95, 1897–1900, 1901–02, 1904; (Second Edition) 241 (N.S.) parts of districts Mandalay, Shwebo, and Hsipaw (N. Shan States), Seasons 1890–93, 1897–98, 1899–1900, 1901–02, 1903; (Second Provisional Edition) 295 (N.S.) parts of district Yamethin and Southern Shan States, Seasons 1894–95, 1899–1900, 1903; (Preliminary Edition) 304 (N.S.) districts Pegu and Toungoo, Seasons 1896–98, 1904; 444 (N.S.) parts of Southern Shan States, Season 1902–03, 1904.—Central Provinces Survey, 1 mile to an inch. Sheets: 262, 263, district Sambalpur, Season 1884–87, 1903.—Central India and Rajputana Survey, 1 mile to an inch. Sheets: 203, parts of States Indore, Gwalior

(C.I. Agency), and of Udaipur (Rajputana Agency), Seasons 1870-71, 1871-72, 1904; (Second Edition) 446, parts of Rewah, Nagode, Jaso, Sohawal, Maihar, and Ajaigarh (C.I. Agency), Seasons 1865-66-67-68, 1902.—Hyderabad Survey, 1 mile to an inch. Sheets: 101, Koolburgah Circar, Season 1824-33, 1884; 173, part of Ghanpura Circar (Nizam's Dominions), Season 1822-23, 1901.—Madras Survey, 1 mile to an inch. Sheets: 14, parts of districts Kadur and Shimoga (Mysore), Seasons 1878-81, 1903; 28, parts of districts Kadur and Hassan (Mysore), Seasons 1879-82, 1902; 49, parts of districts Mysore and Hassan (Mysore) and Coorg, Seasons 1883-84, 1904; 50, parts of districts Hassan and Mysore (Mysore) and Coorg, Season 1883-84, 1903; 150, parts of district Madura, Seasons 1879-88, 1904.—North-West Frontier Province and Punjab Surveys, 1 mile to an inch. Sheets: (Second Edition) 58, 59, district Dera Ismail Khan and Bannu (N.W.F. Province), district Mianwali (Punjab), Season 1874-75, 1876-79, 1903.—Punjab Survey, 1 mile to an inch. Sheets: 197, district Montgomery (Bari Doab), Season 1901-02, 1904; 329, district Kangra (Kullu Subdivision), Seasons 1895-96, 1900-01, 1904; 294, district Karnal, Season 1870-72, 1887-88, 1904; 331 and part of 330, parts of Pandra Bis and Taranda Ranges, Seasons 1895-97, 1901.—Sind Survey, 1 mile to an inch. Sheets: 28, districts Karachi and Larkhana, Season 1900-01, 1904; 41, districts Larkhana and Khairpur State, Season 1901-02, 1903; (Second Edition), 57, district upper Sind Frontier and part of Kalat (Baluchistan), Seasons 1897-98, 1899-1900, 1901; 62, 63, Khairpur State, Season 1901-02, 1904; 80, 97, district Sukkur, Season 1901-03, 1904.—United Provinces Survey, 1 mile to an inch. Sheets: 83, parts of districts Bareilly, Pilibhit and Shahjahanpur, Seasons 1895-1900, 1904; 113, part of district Kheri, Seasons 1893-1900, 1904; 183, district Mirzapur, Seasons 1880-83, 1902; 196, districts Ghazipur and Benares, Seasons 1879-84, 1902; 197, districts Benares and Mirzapur, Seasons 1880-84, 1887-88, 1903.—North-Western Provinces and Oudh Survey, 1 mile to an inch. Sheets: 209, districts Ghazipur and Ballia, Seasons 1874-76, 1880-82, 1901.—Bombay, C.I. and Rajputana Survey, 1 mile to an inch. Sheets: 215 (Bombay), 179 (C.I. and Raj.), parts of district Panch Mahals and Rewa Kantha Agency (Bombay), and of Jhabua State (C.I. Agency), Seasons 1884-85-86, 1904.—Central Provinces Survey. Bengal Survey, 1 mile to an inch. Sheets: 266 (C.P.), 74 (Bengal), parts of States Sonpur and Rairakhol (C.P.), and of Baud and Athmallik (Bengal), Season 1854-55, 1904.—United Provinces and C.I. and Rajputana Survey, 1 mile to an inch. Sheets: 407 (C.I and R.), 62, district Jhansi (U.P.) and Tehri State (C.I.), Season 1895-97, 1904.—United Provinces of Agra and Oudh and Bengal Surveys, 1 mile to an inch. Sheets: 203 (U.P. A. and O.), 27 (Bengal), parts of districts Gorakhpur (U.P. A. and O.), and Champaran (Bengal), Seasons 1886-88, 1895-99, 1902; 215 (U.P. A. and O.), 53 (Bengal), parts of districts Gorakhpur, Champaran, and Saran, Seasons 1884-87, 1892-96, 1902.—Dominions of H.H. Runbir Singh, K.S.I., etc., Jamoo Territories, 2 miles to an inch, Seasons 1857-58-59-60, 6 sheets, 1901.—Maymyo and surrounding country, 1 mile to an inch, Seasons 1893-94, 1898-1900 (Second Edition), 1904.—Index to the map of India and adjacent regions on the scale of 1 : 1,000,000, 1904. *Presented by H.M. Secretary of State for India through the India Office.*

Indo-China. **Service Géographique de l'Indo-Chine.**

Carte de l'Indo-Chine. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. 9 sheets. Paris: Service Géographique de l'Indo-Chine, 1903.

This map has been chiefly compiled from the surveys and route-maps of French officers serving in Indo-China. The northern part, including Yunnan and Burma, requires thoroughly revising and bringing up to date from the recent surveys of Majors Ryder and Davis, and others. The map includes the whole of Tongkin, Siam, Annam, and the neighbouring regions of Burma and China. It is clearly drawn and printed in colours.

Java. **Topographical Bureau, Batavia.**

Overzichtskaart van Java en Madoera. Scale 1 : 500,000 or 7·9 stat. miles to an inch. 8 sheets. Batavia: Topographisch Bureau, 1905.

A well-executed map of Java, printed in colours at the Topographical Bureau at Batavia, from which department many other most excellent maps of the Netherlands East Indies have been issued. It is doubtless the best general map of the island at the present time, and is on a sufficiently large scale to be really useful.

Manchuria. **Topographical Section, General Staff.**

Map of Country west of Ninguta. Scale 1 : 420,000 or 6·6 stat. miles to an inch. May, 1905. London: Topographical Section, General Staff, War Office. *Price 2s. Presented by the Director of Military Operations.*

Vladivostok. **Topographical Section, General Staff.**

Map of Country round Vladivostok. Scale 1 : 420,000 or 6·6 stat. miles to an inch. June, 1905. London: Topographical Section, General Staff, War Office. *Price 2s. Presented by the Director of Military Operations.*

Yunnan. **Service Géographique de l'Indo-Chine.**

Itineraire de A Mi Tchéou a Yunnan-Sen. Scale 1 : 100,000 or 1·6 stat. mile to an inch. 1903. Itineraire de Lao Kay a Mong Tze par la vallée du Sin Chienn Ho. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. 3 sheets. 1900.—De Lao Kay a Mong Tze. Scale 1: 200,000 or 3·1 stat. miles to an inch. Service Géographique de l'Indo-Chine.

These are facsimiles of original route-maps and sketches, showing merely the routes followed and the country immediately adjacent.

AFRICA.

Africa. **Stanford.**

Stanford's Orographical Map of Africa. Compiled under the direction of H. J. Mackinder, M.A. Scale 1 : 7,286,400 or 115 stat. miles to an inch. 4 sheets. London: Edward Stanford, 1905. *Price 16s. Presented by the Publisher.*

Stanford's series of new orographical maps, to which this belongs, promises to be most useful for educational purposes. The Europe appeared some time ago, and now the Africa has just been issued, while others are in course of preparation. They are being compiled under the supervision of Mr. H. J. Mackinder, which is in itself sufficient to guarantee that no pains will be spared to ensure general accuracy and the most satisfactory results as regards the representation of the relief. With reference to the latter, there is much to commend, especially the adoption of shades of one colour—brown—only instead of different colours for land above sea-level. There are altogether six of these tints, ranging from sea-level to over 15,000 feet, and the intervals have been carefully selected to bring out clearly the leading orographical features of the continent. The mountain ranges are also indicated by vertical hachures, but these are so faint that they do not interfere with the tinting, as is often the case when there is an attempt made to combine the two systems. Depths of the surrounding oceans are indicated by tints of blue. The names have been carefully selected, and altogether the four sheets, when mounted, will form an excellent wall-map for schools.

Africa. **Topographical Section, General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Northern Nigeria (Provisional). Sheets: 50-H, K, L, O, P; 51-I, M. London: T.S., G.S., War Office, 1905. *Price 1s. 6d. each sheet. Presented by the Director of Military Operations.*

Gold Coast Colony. **Watherston.**

Plan of Tarkwa District, showing concessions surveyed by the Gold Coast Government Mines Survey, West Africa, under the direction of Major A. E. Watherston, C.M.G., R.E. Scale 1 : 50,000 or 1·3 inch to a stat. mile. 3 Sheets. London: Edward Stanford, 1904. *Presented by His Excellency the Governor of the Gold Coast Colony.*

An outline map without hills. The concessions surveyed are all clearly indicated, and their areas and lengths of sides given in figures upon each of them. Roads surveyed by theodolite are distinguished from those laid down from compass traverses. The map is a good example of the excellent survey work done in the Gold Coast under the superintendence of Major A. E. Watherston.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

LIBERIA
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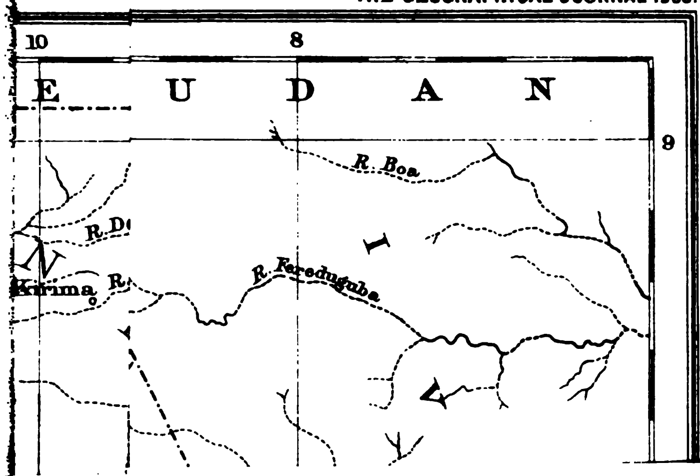
THE GEOGRAPHICAL JOURNAL 1905.



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ON THE NILE FLOOD AND ITS VARIATION.*

By Captain H. G. LYONS, F.R.G.S., F.G.S., Director-General Survey Department, Egypt.

Several writers on the Nile have stated that a certain alternation of high and low floods can be traced. Fritz,† in discussing the maximum readings of the river gauges at Cairo and the Delta Barrage, believed that they followed the curve of sunspots; Sir W. Willcocks ‡ has stated that low Nile floods and deficient monsoons in India coincide; Sir Norman Lockyer § has argued that both Indian rainfall and Nile floods show an alternation corresponding to that of the solar weather; Sir J. Eliot ‖ has shown that a certain periodic oscillation of the atmospheric pressure occurs over India, and he connects with this similar periodical variations in the rainfall. It is, therefore, of considerable importance to determine whether there is any periodical variation in the Nile flood, whether a series of good floods is regularly followed by one of deficient floods, or whether excess and defect succeed one another irregularly. As the flood represents the run-off of an area on which the rains of the East African monsoon fall in June, July, August, and September, it is the variation of this rainfall which has in reality to be studied.

The regimen of a normal flood will first be described, and its volume

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* Research Department, June 16, 1905. Communicated by permission of Sir W. Garstin, G.C.M.G., Adviser to the Public Works Ministry, Egypt. Diagrams, p. 368.

† *Meteor. Zeit.*, 1880, p. 303.

‡ Geographical Congress, Chicago, and 'The Nile in 1904,' p. 87. Cairo: 1905.

§ *Proc. Roy. Soc.*, vol. 67, p. 409.

‖ *Indian Met. Mem.*, vol. 6, pt. ii., 1896.

estimated; the unimportant part played by the White Nile water, as shown by recent observations,* is discussed at some length, since it results from it that the Abyssinian area alone is responsible for the flood supply, and the rainfall of the equatorial regions and the basin of the White Nile and the Bahr-el-Jebel may be neglected in considering the Nile flood; their effect is felt during the falling and low stages of the river.

Dates of Highest and Lowest Levels.

The Nile is at its lowest at Khartum in the middle of May, just before the White Nile begins to rise, and when the Blue Nile flood has not yet arrived. For the nineteen years 1869–1883 and 1900–1903, the average date of the lowest gauge-reading at Khartum was May 13; the extreme dates begin April 16, 1900, and May 29, 1882.

The highest level at Khartum is usually reached early in September, the earliest date in these years being August 16, and the latest September 29, 1881, when the Abyssinian rains were unusually prolonged, though they were not heavy. The mean date for the maximum deduced from these years is September 6, and the mean deviation from this date is ten days.

TABLE I.

Year.	Date of lowest reading.	Difference from mean date.	Date of highest reading.	Difference from mean date.
1869	May 19	+ 6	Sept. 5	− 1
1870	,, 20	+ 7	Aug. 17	−20
1871	,, 17	+ 4	,, 16	−21
1872	,, 8	− 5	Sept. 6	0
1873	,, 12	− 1	,, 2, 9, 10	0
1874	,, 8	− 5	,, 4, 5	− 2
1875	,, 8, 16, 25	+12	,, 20	+14
1876	,, 8, 21	+ 8	,, 12	+ 6
1877	,, 10	− 3	Aug. 29, 30	− 7
1878	,, 10	− 3	Sept. 21, 22	+16
1879	,, 10	− 3	,, 9, 10, 11	+ 4
1880	,, 13	0	,, 23	+17
1881	,, 20	+ 7	,, 29	+23
1882	,, 29	+16	Aug. 28	− 9
1883	,, 24	+11	Sept. 11	+ 5
1900	April 16	−27	Aug. 17	−20
1901	,, 18	−25	Sept. 1, 20	−11
1902	May 6	− 7	,, 14	+ 8
1903	,, 15	+ 2	,, 4	− 2

Mean date of lowest reading, May 13.
Mean date of highest reading, September 6.
Mean variation from date of maximum, ten days.

* 'A Report on the Basin of the Upper Nile,' by Sir W. Garstin, p. 164. Cairo: 1904.

At Aswan, for the series of years 1873–1902, the mean date for the lowest reading was June 1, the earliest being May 5, 1887, and the latest June 22, 1882, while the average deviation from the date was ten days. Here the mean date for the highest stage, as deduced from the thirty-four years 1869–1902, is September 4, the earliest date being August 19, and the latest being October 1, while the mean deviation from September 4 is eight days.

TABLE II.

Year.	Minimum.			Maximum.		
	Date.	After April 30.	Difference from mean date.	Date.	After August 15.	Difference from mean date.
1869		Doubtful		Sept. 4	20	0
1870	June 11	45	+13	,, 7	23	+ 3
1871	,, 16	47	+15	Aug. 18	3	−17
1872	May 25	25	− 6	Sept. 18	34	+14
1873	June 3	34	+ 2	,, 1	17	− 3
1874	May 28	28	− 4	,, 6	22	+ 2
1875	,, 23	23	− 9	,, 11	27	+ 7
1876	June 11	42	−12	,, 7	23	+ 3
1877	May 26	26	− 6	Aug. 20	5	−15
1878	June 8	39	+ 7	Oct. 1	46	+26
1879	May 23	23	− 9	Sept. 13	29	+ 9
1880	June 3	34	+ 2	,, 2	18	− 2
1881	May 14	14	−18	,, 4	20	0
1882	June 22	53	+21	Aug. 28	13	− 7
1883	May 27	27	− 5	Sept. 17	33	+13
1884	,, 25	25	− 7	,, 1	17	− 3
1885	June 20	51	+19	Aug. 28	13	− 7
1886	,, 3	34	+ 2	Sept. 22	38	+18
1887	May 5	5	−27	,, 1	17	− 3
1888	June 4	35	+ 3	Aug. 24	9	−11
1889	,, 4	35	+ 3	Sept. 1	17	− 3
1890	May 28	28	− 4	,, 2	18	− 2
1891	,, 17	17	−15	,, 7	23	+ 3
1892	June 5	36	+ 4	,, 20	36	+16
1893	,, 18	49	+17	,, 14	30	+10
1894	May 8	8	−14	Aug. 25	10	−10
1895	June 21	52	+20	,, 22	7	−13
1896	,, 11	42	+10	Sept. 2	18	− 2
1897	May 27	27	− 5	,, 1	17	− 3
1898	June 21	52	+20	Aug. 28	13	− 7
1899	,, 1	32	+ 0	Sept. 4	20	0
1900	May 26	26	− 5	Aug. 19	4	−16
1901	,, 10	10	−22	Sept. 6	22	+ 2
1902	June 6	37	+ 5	,, 17	33	+13
Mean	June 1	—	± 10	Sept. 4	—	± 8

It is noticeable that the mean date for the highest gauge-reading is two days earlier for Khartum than for Aswan, and if corresponding years are taken from the two tables, it will be found that the date of the highest gauge-reading at Aswan often precedes that of Khartum, sometimes by as much as twenty days (1880 and 1881). This is due to the Atbara river, which, being in highest flood soon after the middle of August, may, with the increasing Blue Nile flood, cause a higher reading at

Aswan than their combined waters at the time when the Blue Nile is at its maximum and the Atbara has fallen. The Atbara drains a part of Abyssinia to the north of the basin of the Abai or Blue Nile, and the rains in the northern basin decrease earlier than those of the more southern districts of Gojam and Wallega.

Beginning of Rise.—The season of lowest Nile is marked by the unusual greenness of the water, which has a marshy and putrid taste and smell, which boiling or distilling only increases. The green colour is due to large quantities of microscopic algæ * which are floating in the water, and it is the oil contained in some of these which gives the unpleasant taste and smell. Since d'Arnaud, after his visit to the Bahr-el-Jebel in 1841, attributed this algæ-laden water to the rising flood of that river which forced out of the lagoons and marshes the stagnant water which had been lying there, later writers have accepted his explanation of this "green water." It is not, however, a satisfactory one. The earliest rise of any magnitude in the Bahr-el-Jebel at Gondokoro, 4° 55′ N. lat., does not take place until June, while the green water is usually seen about Dueim, 14° N. lat., in the middle of May. Observations in particular years give the same result, and in 1902 the green water was filling the White Nile at Dueim and northwards nearly as far as Khartum on May 11, on which date the Bahr-el-Jebel at Gondokoro rose markedly for the first time that year.

The green water at Dueim in May cannot, therefore, be that which has been forced out of the marshes of the Bahr-el-Jebel by the rising flood. I have suggested * that it may be brought down the Sobat from the Pibor marshes, as the first rise of the Baro takes place in the beginning of May; but in 1903 the first rise of the river at Doleib Hilla (25 kilometres from the junction of the Sobat with the White Nile) was marked by muddy and not by green water, and in 1902 no green colour was noticed. It seems, therefore, that while these minute algæ are brought down throughout the year by the water from the marshes of the Bahr-el-Jebel and the Bahr-el-Ghazal, they do not multiply rapidly in the White Nile until conditions of hot sun and low velocity of current appear, such as occur in May. Dr. Schweinfurth has suggested that this growth of algæ may take place in the pools and backwaters of the different cataracts; and as the conditions there must be entirely favourable, it is probable that it does do so, but only to a small extent, since the area would be but small; in any case, it has not been actually observed there. Mr. T. Barron noticed in August, 1903, this same green coloration of the water at Dueim, when the White Nile water was being held up by the Blue Nile flood, and the current in the White Nile was hardly appreciable. This confirms the view that these algæ grow in the White Nile reach when conditions are favourable, and are not brought down from the marshes of the Pibor,

* Kaufmann, 'Revue de l'Egypte,' p. 105. Cairo: 1897.

since the Sobat is in August discharging 800 to 900 cubic metres per second of reddish muddy water. On reaching Egypt in June, this green water occupies a considerable length of the river—500 kilometres, according to Kaufmann, who made observations on this point in 1886. As in May the White Nile is furnishing practically the whole supply of the Nile, this green water fills the river, and becomes greener as the algæ multiply. After June the rising flood of the Blue Nile is on its way down the river, and, flowing with greater velocity than the green water, overtakes it, carrying it down before it, and producing the phenomenon of the sudden change from the green water to the muddy red-brown flood.

Rise at Khartum.—At Khartum the rise commences quickly; for a few days the gauge shows a slight increase, and then rises steadily. In most years there are small rises and falls which interrupt the steady rise, due to variations in the volume of water poured in by the different tributary streams in the upper reaches of the river. In the mean curve taken from fourteen years (1869–83), Fig. I., these irregularities do not appear, and a steady rise is shown, which varies from one metre in fifteen days at first to one metre in ten days at the end of July. In the middle of August the rise becomes slow, and the flood stage is reached usually at the end of the first week in September. The fall then commences, and by September 20 is well advanced, the gauge falling a metre in about sixteen days.

Similar mean gauge curves are given in Fig. I. for Wadi Halfa and Aswan. Though these are not for the same fourteen years as the Khartum curve, all the three probably differ but very little from the true mean curves, and may be compared with one another without introducing any error. They are similar in general character, but differ somewhat in the shape of the curve.

While the Khartum curve rises at once and with a fairly regular increase, those of Wadi Halfa and Aswan rise very slowly for the first three weeks, and then a more rapid rise takes place.

This is clearly shown in the following table, taken from the mean curves:—

TABLE III.

Days after May 20.	Rise of mean gauge at—					
	Khartum.	Rise in ten days.	Wadi Halfa.	Rise in ten days.	Aswan.	Rise in ten days.
	metres.	metre.	metre.	metre.	metre.	metre.
10	0·47	0·47	0·00	0·00	0·00	0·00
20	1·01	0·54	0·10	0·10	0·08	0·08
30	1·51	0·50	0·30	0·20	0·30	0·22
40	2·25	0·74	0·75	0·55	0·86	0·56
50	3·10	0·85	1·25	0·50	1·55	0·69

* Bluebook, Egypt, No. 1, 1903, p. 70.

The delay of the rise at Wadi Halfa is due to the amount of water which is taken up by the sandbanks and low shallow reaches when the flood first comes down. About a month's delay is caused by this, together with the move of the flood-wave from Khartum to Aswan, before the flood can be said to be rising rapidly at Wadi Halfa. The first rise is felt apparently at Wadi Halfa about fifteen days after the rise has commenced at Khartum.

The fall begins at Khartum about September 20, and at Wadi Halfa and Aswan a few days later.

Range of Flood at Khartum.—The fifteen years of gauge-readings at Khartum from 1869 to 1883 do not cover exactly the same period of each year. Though in ten years the readings begin on the 8th, 9th, or 10th of May, in the first five years it is not until the 18th or 20th, while they end on various dates from September 5 to November 8. It is not, therefore, quite certain that the absolute lowest reading of the year is recorded; but in all cases the lowest reading given must be very near it, while in every year except 1869 the maximum can be found without any doubt.*

The following table gives the lowest and highest readings recorded, together with the range for each year:—

TABLE IV.

Year.	Lowest gauge-reading.	Highest gauge-reading.	Range.
	metres.	metres.	metres.
1869	5·44	13·50	8·06
1870	5·40	13·32	7·92
1871	6·48	13·00	6·52
1872	6·52	13·21	6·69
1873	6·48	12·42	5·94
1874	6·57	13·77	7·20
1875	6·48	13·25	6·77
1876	6·48	13·50	7·02
1877	6·52	11·74	5·20
1878	6·55	14·06	7·51
1879	7·93	13·32	5·39
1880	5·82	12·80	6·90
1881	5·92	13·23	7·31
1882	5·44	12·64	7·20
1883	5·92	13·34	7·42
Means	6·26	13·14	6·88
1900 †	−0·48	+6·27	6·75
1901	−0·08	+6·10	6·18
1902	−0·10	+5·50	5·60
1903	−0·26	+6·20	6·46

Dr. Peney ‡ gives the mean range of the Nile here as 6 metres as the mean of ten years' observations between 1840 and 1860, but this would seem to be too low a value.

* See *post*. † A different gauge.

‡ *Bull. Soc. Geog.*, p. 33. Paris: July, 1863.

Until recently the available determinations of the volume of the upper Nile in flood have not been numerous, and the measurements which had been made did not agree well among themselves; besides this, the proportion furnished in flood by the White and Blue Nile respectively was quite uncertain. Linant considered them at the end of July to be practically equal; Peel made the Blue Nile to be double the volume of the White Nile at the end of October; but all observers agreed in describing the Blue Nile flood as sweeping across the White Nile, and forcing its stream of whitish water against the left bank, while the Blue Nile flood of muddy reddish water occupied the greater part of the channel.

The discharges measured by older travellers, together with those recently obtained, comprise the data that exist at present for comparing the volumes of the two main streams and their different tributaries.

Discharge of the Nile at Khartum.—The first who measured the discharge of the Nile at Khartum was Linant de Bellefonds,* who measured the White Nile on March 4, and the Blue Nile on March 5, 1822, giving as the combined discharge about 456 cubic metres per second.

	White Nile, March 4.	Blue Nile, March 5.
Area of section	582·8 square metres	360·3 square metres
Mean surface velocity ...	0·51 metre per second	0·44 metre per second
Discharge	297·2 cubic metres per second	158·5 cubic metres per second

In July, 1827, not in September as stated by Sir W. Willocks in 'The Nile in 1904,' p. 42, he again measured the discharge, with the following results †:—

	White Nile, July 26.	Blue Nile, July 30.
Area of section	3924·5 square metres	3288·1 square metres
Mean surface velocity ...	1·54 metre per second	1·9 metre per second
Discharge	6043·7 cubic metres per second	6247·3 cubic metres per second

The combined Nile near Alifun ‡ at the end of July, 1827, gave—

Area of section	6982·2 square metres
Surface velocity	1·72 metre per second
Discharge	12,000 cubic metres per second

but of course none of these July discharges represented the full flood.

* *Bull. Soc. Geog.*, p. 436. Paris: 1852.

† *Bull. Soc. Geog.*, p. 436. Paris: 1852.

‡ Evidently a place below the junction is meant, but to-day a place of similar name exists a short distance up the Blue Nile.

The discharge of the combined stream below the junction does not appear to have been separately measured in March.

Petherick * gives the result of measurements of the White and Blue Niles at Khartum on July 5, 1848, when he states the Nile was nearly at its highest; but this cannot be the case, since the maximum of the Khartum gauge occurs in September—

	Width.	Greatest depth.	Velocity.
White Nile,	500 yards	22 feet	2½ miles per hour
Blue Nile,	750 yards	20 feet	Nearly 2 miles per hour

These measurements correspond to sectional areas of about 2700 square metres and 4000 square metres respectively, and if the velocities are accepted, the discharges will be 3000 cubic metres per second for the White Nile, and 3700 cubic metres for the Blue Nile.

In October, 1851, a set of discharges was taken by Captain W. Peel †—

	White Nile.	Blue Nile.	Combined Nile.
Width	480 yards	768 yards ‡	1107 yards ‡
Average depth ...	13·92 feet	16·11 feet	14·38 feet
Average velocity ...	1·17 knot per hour	1·564 knot per hour	2·0 knots per hour
Number of observations for velocity	10	7	7
Discharge	2,985,400 cubic feet per minute	5,820,600 cubic feet per minute	9,526,700 cubic feet per minute
Date	October 25, 1851	October 24, 1851	October 23, 1851

The above results of Captain Peel, expressed in the metric system, are—

	White Nile.	Blue Nile.	Combined Nile.
Average depth, metres	4·24	4·93	4·38
Average velocity, metres per second	0·757	0·806	1·03
Discharge, cubic metres per second	1410	2749	4500

In March, 1876, L. A. Lucas measured the velocity of the Blue Nile at Khartum, but as he gives no measured section, the discharge cannot be satisfactorily deduced from his observations. In a letter to Dr. Schweinfurth, who has kindly communicated it, Lucas states that the discharge was about 780 cubic metres per second; but this is too high a value for March, and may be rejected.

In 1876, other measurements at Khartum gave the following results in cubic metres per second § :—

* 'Egypt and the Sudan,' p. 330. Edinburgh: 1861.

† 'A Ride across the Nubian Desert,' by Captain W. Peel. London: 1852.

‡ Taken as 760 yards and 1090 yards for calculation by Captain Peel.

§ 'Chélu. Le Nil, le Soudan, l'Egypte,' p. 38. Paris: 1891.

	White Nile.	Blue Nile.
March	369	198, low stage
June...	1050 *	—
September	4351 *	4398,† flood
December	2720	—

In April, 1883, both of the branches of the Nile at Khartum were measured by J. M. Schuver.‡

White Nile.—Taken on April 21, 1883, 200 metres above the junction with the Blue Nile, where the river was narrowed by an island. Above this point the river was 600–800 metres wide.

	Metres.	Metres.	Metres.	Metres.	Metres.	Metres.	Metres.
Distance from east bank ...	30·0	55·0	80·0	94·0	108·0	133·0	158·0
Depth	0·5	2·5	4·0	5·5	8·5	4·0	1·0

Area of section = 524 square metres, while the velocity was 100 metres in 1 minute 10 seconds = 1·43 metre per second. Discharge = 750 cubic metres per second.

Blue Nile.—Taken on April 21, 1883. Of the total breadth of 320 metres, 140 metres was water and 180 metres sandbank.

	Metres.	Metres.	Metres.	Metres.	Metres.
Distance from north bank	20·0	50·0	70·0	90·0	120·0
Depth	4·0	11·0	6·0	3·5	1·0

Area of section = 607·5 square metres, and the velocity = 100 metres in 4 minutes 30 seconds, or 0·27 metre per second. Discharge = 225 cubic metres per second.

Collecting the various results, we obtain the following table :—

TABLE V.

Date.	White Nile, cubic metres per second.	Blue Nile, cubic metres per second.	Combined Nile, cubic metres per second.
March 4–5, 1822 ...	297	158	—
July 26–30, 1827 ...	6044	6247	12,000
July 5, 1848	3000	3700	—
October 23–25, 1851 ...	1410	2749	4500
March, 1876	369	—	—
Low stage, 1876 ...	—	198	—
June ,, ...	1050	—	—
Flood ,, ...	—	4398	—
September ,, ...	4351	—	—
December ,, ...	2720	—	—
April, 1883	750	225	—

* This value is too high.

† Much too low, as in 1876 the Nile was above the average in September.

‡ *Pet. Mitt.*, 1883, p. 268.

From May, 1902, until January, 1904, a series of discharges of the Blue Nile were carefully taken by Messrs. Barron, Beadnell, and Hume, of the Egyptian Survey Department, about 5 kilometres above Khartum, of the White Nile at Dueim, 320 kilometres above Khartum; and by the late Captain C. H. Wood, of the Atbara, 35 kilometres from its mouth. These discharges were all taken with a Price's current meter, used from a boat, which was passed across the river by means of a hawser, so that intervals could be measured and soundings taken as often as required. The width was verified by means of a theodolite, and any stretching of the rope allowed for. The following tables, VI., VII., and VIII., give the results for the White Nile at Dueim, and the Blue Nile at Buri, just up-stream of Khartum, and for the Atbara at Abadar.

TABLE VI.

WHITE NILE, DUEIM.

Date.	Mean velocity in metres per second.			Discharge in cubic metres per second.				Gauge in metres.
	E	I	W	E	I	W	Total.	
1902.								
May 13	0·198	—	0·255	87	—	260	347	0·51
June 11	0·314	—	0·426	205	—	445	650	1·00
July 8	0·314	—	0·396	277	—	511	788	1·44
August 5 ..	0·311	—	0·284	385	—	482	867	2·20
September 2 ...	0·061	—	0·165	37	—	293	330	3·48
October 1 ...	0·196	—	0·276	360	—	510	870	3·50
,, 28 ...	0·268	—	0·266	365	—	437	802	2·50
December 1 ...	0·306		0·337	392	—	538	930	2·05 (?)
,, 29 ...	0·506	—	0·567	623	—	895	1518	2·02
1903.								
January 27 ...	0·257	—	0·347	213	—	450	663	1·12
February 24 ...	0·187	—	0·300	127	—	335	462	0·46
March 24 ...	0·277	—	0·452	137	—	422	559	0·86
April 21	0·243	—	0·416	109	—	306	415	0·36
May 19	0·297	—	0·373	122	—	325	447	0·38
June 16	0·277	—	0·379	208	—	450	658	1·09
July 1	0·335	—	0·416	311	—	573	884	1·31
,, 14	0·298	—	0·318	313	—	522	835	1·71
August 4 ...	0·217	—	0·264	304	10	454	768	2·46
,, 11 ...	0·125	0·087	0·131	228	31	320	579	3·28
,, 18 ...	0·136	0·143	0·097	254	62	218	534	3·68
,, 23 ...	0·127	0·084	0·130	270	46	338	654	4·08
,, 28 ...	0·125	0·113	0·142	269	62	379	710	4·19
September 2 ...	0·155	0·126	0·094	332	75	164	571	4·32
,, 7 ...	0·158	0·108	0·119	357	62	318	737	4·44
,, 12 ...	0·150	0·084	0·110	309	51	293	653	4·46
,, 18 ...	0·183	0·090	0·142	397	53	390	840	4·23
,, 24 ...	0·147	0·114	0·148	320	65	378	763	4·31
October 7 ...	0·308	0·225	0·255	700	110	778	1588	3·93
November 3 ...	0·400	0·163	0·404	680	35	848	1563	3·11
,, 24 ...	0·450	—	0·457	773	—	892	1665	2·44
December 8 ...	0·419	—	0·427	629	—	833	1462	2·06
,, 22 ...	0·411	—	0·415	620	—	783	1403	1·80

E = east channel; I = island, submerged in flood; W = west channel.

TABLE VII.

Blue Nile.

Discharges taken 5 kilometres above Khartum.

Date.	Mean velocity in metres per second.	Discharge in cubic metres per second.	Gauge in metres.	Date.	Mean velocity in metres per second.	Discharge in cubic metres per second.	Gauge in metres.
1902.				1903.			
May 9	0·120	184	−0·05	March 6 ...	0·162	202	0·19
,, 23	0·124	194	+0·16	,, 20 ...	0·182	201	0·04
June 6	0·314	604	0·76	April 3 ...	0·124	132	−0·12
,, 20	0·372	695	1·06	,, 17 ...	0·132	154	−0·16
,, 27	0·393	837	1·30	May 1	0·106	121	−0·22
July 4	0·507	1082	1·75	,, 8	nil.	not	−0·23
,, 11	0·616	1453	2·07	,, 15	nil.	measure-	−0·26
,, 18	0·668	1612	2·33	,, 22	nil.	able	−0·09
,, 25	0·702	1885	2·64	,, 28	0·235	374	+0·53
August 1 ...	1·098	3420	3·34	June 6	0·505	970	1·40
,, 8 ...	1·344	4880	4·20	,, 19	0·680	1500	1·90
,, 15 ..	1·322	4720	4·50	,, 26	0·524	1089	1·58
,, 22 ...	1·545	5540	4·93	July 3	0·628	1314	1·78
,, 29 ...	1·745	7180	5·34	,, 10	0·803	1952	2·48
September 5 ...	1·502	6580	5·27	,, 17	0·882	2267	2·75
,, 12 ...	1·620	5800	5·35	,, 24	1·177	3183	3·40
,, 19 ...	1·590	5760	5·30	,, 31	1·084	2870	3·45
,, 26 ...	1·428	4860	5·10	August 5 ...	2·103	7584	4·60
October 3 ...	1·470	4880	5·03	,, 10 ...	1·715	7100	5·06
,, 10 ...	1·096	3250	4·45	,, 14 ...	2·456	9340	5·65
,, 17 ...	0·931	2460	3·73	,, 21 ...	2·796	9519	5·90
,, 24 ...	0·833	2030	3·40	,, 28 ...	2·566	9544	6·05
,, 31 ...	0·535	1244	3·00	September 4 ...	2·094	8474	6·20
November 7 ...	0·580	1272	2·77	,, 11 ...	1·960	8385	6·15
,, 14 ...	0·461	1035	2·48	,, 18 ...	1·814	7070	5·88
,, 21 ...	0·463	802	2·23	,, 25 ...	1·879	8965	6·08
,, 28 ...	0·394	787	2·11	October 2 ...	1·518	6581	5·53
December 5 ...	0·323	654	1·94	,, 9 ...	1·493	5749	5·15
,, 12 ...	0·288	486	1·80	,, 16 ...	1·105	3812	4·45
,, 28 ...	0·281	476	1·58	,, 23 ...	1·210	4198	4·56
1903.				,, 30 ...	0·945	2893	4·00
January 2 ...	0·216	348	1·39	November 6 ...	0·800	2275	3·50
,, 9 ...	0·182	270	1·22	,, 13 ...	0·679	1790	3·10
,, 16 ...	0·166	248	1·09	,, 20 ...	0·579	1456	2·65
,, 23 ...	0·178	250	0·94	December 4 ...	0·472	1102	2·35
February 6 ...	0·168	223	0·60	,, 18 ...	0·356	789	1·90
,, 20 ...	1·114	152	0·39	,, 25 ...	0·318	722	1·88

TABLE VIII.

Atbara River.

Discharges taken in 1903 at Abadar, 30 kilometres from Nile.

Date.	Mean velocity in metres per second.	Discharge in cubic metres per second.	Gauge in metres.	Date.	Mean velocity in metres per second.	Discharge in cubic metres per second.	Gauge in metres.
July 16	0·838	381	2·00	September 5 ...	1·435	2822	5·53
,, 23	0·964	538	2·43	,, 12 ...	1·336	2091	4·95
,, 27	1·008	780	3·02	,, 18 ...	1·161	1672	4·57
August 2 ...	0·939	758	3·07	,, 25 ...	1·032	1267	3·83
,, 5 ...	1·203	1448	4·24	,, 28 ...	0·876	902	3·28
,, 14 ...	1·491	2318	5·15	October 2 ...	0·914	925	3·24
,, 15 ...	1·621	2931	5·67	,, 4 ...	0·838	754	3·01
,, 27 ...	1·679	2632	5·09	,, 5 ...	0·835	703	2·82
,, 30 ...	1·609	3088	5·61				

Volume discharged July 16 to October 5, 11,972·4 millions of cubic metres.

In these discharges the holding up of the White Nile water by that of the Blue Nile, when the latter is in flood, is very markedly shown, and the slackening of the current at this time of the year is a fact well known to the boatmen of the White Nile. It is this which leads to the extensive flooding which takes place above Khartum, filling the khors and low-lying land along the river with water, which drains off when the Blue Nile flood has fallen sufficiently; this is usually in October. To further prove this, a series of measurements were made in the White Nile close to Khartum, just above the junction with the Blue Nile, in order to see if there was a very feeble velocity there, and the data obtained are inserted here, as it is important to demonstrate that the flood is practically independent of the White Nile, and therefore the meteorological conditions and the rainfall in that basin are negligible in a discussion of the Nile flood. Seven sets were taken during August and September, 1903, and the results are of considerable interest.*

On August 7, 1903, the measurements were made 1 kilometre above the ferry between Omdurman and Khartum; one point was in the eastern half of the channel, the other in the western half.

East channel.		West channel.	
Depth from surface.	Velocity.	Depth from surface.	Velocity.
metres.	metres per second.	metres.	metres per second.
0	0	0	0
1	0	1	0
2	0	2	0
3	0	3	0
4	0	4	0

On August 23, 1903, measurements were made at three points—the first, A, was in the centre of the White Nile channel close to the incoming water of the Blue Nile; the second was in the main channel 1 kilometre up-stream; the third point was opposite the village of Ramela, 5 kilometres from the junction of the two Niles. At a short distance down-stream of A, the turbid waters of the Blue Nile could be seen carrying down with them masses of the clear White Nile water.

August 23—

Depth from surface.	A.	B.	C.
metres.	metres per second.	metres per second.	metres per second.
0	0·276	0·243	0·264
1	0·172	0·150	0·198
2	0·195	0·083	0·099
3	0·218	0·034	0·075
4	0·230	0·048	0·039
5	0·195	0·018	0·023
6	0·264	—	0·057
7	0·184	—	0·078
8	—	—	0·034
Mean	0·217	0·096	0·096

* The following details are taken from the original observations, by the kind permission of Sir W. Garstin, G.C.M.G.

After these preliminary experiments, the measurements were made on August 28, September 4, September 11, September 18, and September 24, off Ramela, at different distances from the right bank—

August 28—

Depth from surface.	From right bank. I. 700 metres.	II. 1200 metres.	III. 1400 metres.	IV. 1600 metres.
metres.	metres per second.	metres per second.	metres per second.	metres per second.
0	0·000	0·076	0·034	0·000
1	0·023	0·044	0·000	0·000
2	0·000	0·028	0·014	0·000
3	—	0·009	0·000	0·000
4	—	0·000	0·023	—
5	—	0·000	0·053	—
6	—	0·000	—	—
7	—	0·000	—	—
8	—	0·000	—	—
Mean	0·008	0·017	0·021	0·000

September 4—

Depth from surface.	From right bank. I. 700 metres.	II. 900 metres.	III. 1200 metres.	IV.
metres.	metres per second.	metres per second.	metres per second.	
0	0·391	0·299	0·345	Too rough to continue; southerly gale.
1	0·278	0·200	0·255	
2	0·306	0·242	0·283	
3	0·278	0·333	0·230	
4	0·290	0·200	0·188	
5	0·368	0·257	0·181	
6	—	0·271	0·191	
7	—	0·306	0·195	
8	—	—	0·131	
Mean	0·318	0·264	0·222	

The effect of the wind in forcing down the White Nile water is here very marked.

September 11—

Depth from surface.	From right bank. I. 800 metres.	II. 1100 metres.	III. 1600 metres.	IV. 2100 metres.
metres.	metres per second.	metres per second.	metres per second.	metres per second.
0	0·241	0·276	0·267	0·278
1	0·051	0·126	0·165	0·167
2	0·021	0·125	0·125	0·161
3	0·000	0·071	0·103	0·126
4	0·000	0·067	0·078	0·136
5	—	0·043	0·078	—
6	—	0·000	0·078	—
7	—	0·012	0·062	—
8	—	0·014	—	—
Mean	0·063	0·082	0·120	0·174

September 18—

Depth from surface.	I. 700 metres.	II. 950 metres.	III. 1250 metres.	IV. 1650 metres.	V. 1950 metres.
	From right bank.				
metres.	metres per sec.	metres per sec.	metres per sec.	metres per sec.	metres per sec.
0	0·276	0·315	0·292	0·260	0·202
1	0·115	0·108	0·124	0·120	0·085
2	0·039	0·044	0·087	0·085	0·037
3	—	0·030	0·067	0·071	0·000
4	—	0·016	0·057	0·057	—
5	—	0·000	0·051	0·032	—
6	—	—	0·028	0·009	—
7	—	—	0·025	—	—
8	—	—	0·000	—	—
Mean ...	0·143	0·086	0·081	0·091	0·081

September 25—

Depth from surface.	I. 600 metres.	II. 900 metres.	III. 1200 metres.	IV. 1750 metres.	V. 2250 metres.
	From right bank.				
metres.	metres per sec.	metres per sec.	metres per sec.	metres per sec.	metres per sec.
0	0·237	0·276	0·287	0·276	0·308
1	0·131	0·140	0·140	0·113	0·162
2	0·043	0·048	0·039	0·067	0·046
3	0·000	0·016	0·037	0·018	0·018
4	—	0·032	0·000	0·034	—
5	—	0·016	0·000	0·007	—
6	—	—	0·000	—	—
7		—	0·000	—	—
8	—	—	0·000	—	—
Mean ...	0·103	0·088	0·056	0·086	0·132

The mean velocities in the White Nile at Dueim and in the Blue Nile above Khartum about the same dates were—

Date.	White Nile at Dueim.	Date.	Blue Nile above Khartum.	
	metres per second.*		metres per second.	
August 4	0·240	August 5	2·103	
,, 23	0·114	,, 21	2·796	
,, 28	0·127	,, 28	2·566	Maximum discharge of Blue Nile.
September 2	0·125	September 4	2·094	
,, 12	0·115	,, 11	1·960	
,, 18	0·138	,, 18	1·814	
,, 24	0·136	,, 25	1·879	

From these results the effect of the Blue Nile flood is plainly seen; the complete absence of current on August 4 was, doubtless, the result of the sudden arrival of the main flood of the Blue Nile about August 2 and 3, when the discharge rose from 2870 cubic metres per second on July 31 to 7584 cubic metres per second on August 5.

* The mean of the mean velocities in the two channels and over the flooded island.

It is now easy to see how Linant obtained his discharge of 6044 cubic metres per second for the White Nile in flood. He took his measurements on July 26, 1827, and therefore before the Blue Nile had reached its maximum; the surface velocity he obtained of 1·54 metre per second must have been taken very near the junction with the Blue Nile to have so high a value, since at Dueim 0·567 metre per second is the highest mean velocity recorded in 1902 and 1903; the velocity thus obtained applied to the whole or a greater part of the White Nile section will account for the high discharge obtained.

Throughout July and August, 1903, at Dueim on each occasion that a discharge was taken, the velocity was also measured at each successive metre from the surface at the deepest part of the section.

The water was found to be moving at all parts of the section until September 2, when there was a distinct reduction of the velocity near the bottom at several of the points at which the velocity was measured; this layer varied apparently from 1 to 2 metres in the thickness. The same occurred on September 7, but to a less extent. On September 12 there was a layer of water a metre deep at the bottom which was not appreciably moving. This was found to be the case at five points—at 130, 175, and 265 metres from the east bank, and at 148 and 193 metres from the west bank. After this date the water was moving throughout the section.

The earlier observations agree fairly well with those obtained in 1902 and 1903 at Khartum and Dueim for the Blue Nile and for the White Nile at low stage, but the flood discharges of the White Nile show a very large discrepancy—

1902.	Cubic metres per second.	1903.	Cubic metres per second.	Previous measurements.	Cubic metres per second.
July 8	827	July 14	835	July 5, 1848	3000
August 5	910	August 4	768	July 30, 1827	6044
Sept. 2	350	Sept. 2	571	Sept., 1876	4351

Thus it is evident that the surface velocities taken by former observers give a wholly false result, since the greater part of the White Nile is being held up by the flood of the Blue Nile, and only a surface stratum of water near the junction was passing down with a velocity nearly the same as that of the Blue Nile water. It may even be that at times some water flows from the Blue Nile *up* the White Nile channel, but only for a very short time, and not throughout July and August,* as has been stated. Seeing, too, that the Sobat flood-

* Willcocks, 'The Nile in 1904,' p. 57. Cairo: 1905. See also Lyons, 'The Ruins of the Nile Basin in 1904.' Cairo: 1905.

supply must be estimated at less than 1500 cubic metres per second, and that of the Bahr-el-Zaraf, Bahr-el-Jebel, and Bahr-el-Ghazal combined at less than 600 cubic metres per second,* the maximum discharge can rarely reach 2000 cubic metres per second under the present conditions, when the amount of flooding in the Taufikia-Khartum reach, and the amount of water which the marshes lining its banks must absorb, is taken into account; also the discharges for 1902 and 1903 show that the maximum discharge of the White Nile takes place in December when the floods are subsiding, after the Blue Nile has fallen.

Taking now the discharges of the Blue Nile in Khartum, which were measured in 1902 and 1903, we can obtain an approximate value for the volume of water which passed down the Blue Nile in the floods of those years. From the measured discharges taken every seven days, the daily discharge in cubic metres per second has been estimated, and from these five-day means have been obtained, which are given in the following table:—

TABLE IX.

1902 Flood.	Mean discharge in cubic metres per second.	Volume discharged during period in millions of cubic metres.
July 1- 5	1100	475·2
,, 6-10	1330	574·5
,, 11-15	1480	639·3
,, 16-20	1600	691·2
,, 21-25	1800	777·6
,, 26-31	2700	1399·6
August 1- 5	4030	1741·0
,, 6-10	4720	2039·0
,, 11-15	4900	2116·8
,, 16-20	5200	2246·4
,, 21-25	6000	2592·0
,, 26-31	6900	3577·0
September 1- 5	6950	3002·4
,, 6-10	6450	2786·4
,, 11-15	6100	2635·2
,, 16-20	5900	2548·8
,, 21-25	5450	2354·4
,, 26-30	5020	2602·4
October 1- 5	4830	2086·6
,, 6-10	4040	1745·3
,, 11-15	3100	1339·2
,, 16-20	2650	1144·8
,, 21-25	2170	937·4
,, 26-31	1650	855·4
	Total ...	... 42,907·9

For the same period in 1903 we obtain in the same way the following table:—

* Garstin, 'A Report upon the Basin of the Upper Nile,' p. 164. Cairo: 1904.

TABLE X.

1903 Flood.	Mean discharge in cubic metres per second.	Volume discharged during period in millions of cubic metres.
July 1- 5	1290	556·8
,, 6-10	1790	771·6
,, 11-15	2190	944·8
,, 16-20	2600	1123·2
,, 21-25	2950	1274·4
,, 26-31	2950	1529·3
August 1- 5	5220	2225·0
,, 6-10	7250	3132·0
,, 11-15	8250	3564·0
,, 16-20	9420	4069·4
,, 21-25	9500	4138·6
,, 26-31	9500	4950·7
September 1- 5	8850	3823·2
,, 6-10	8400	3628·8
,, 11-15	7950	3434·4
,, 16-20	7450	3218·4
,, 21-25	8250	3564·0
,, 26-30	8100	4199·0
October 1- 5	6700	2894·4
,, 6-10	5800	2505·6
,, 11-15	4850	2095·2
,, 16-20	4150	1792·8
,, 21-25	3850	1663·2
,, 26-31	3150	1632·9
	Total ...	... 62,761·8

Thus the volume of the Blue Nile flood of 1902 was to that of 1903 approximately as 42,908 to 62,762, or as 0·68 to 1·00.

They may be compared with previous years by means of the Wadi Halfa gauge records, by taking the mean of the readings for each day for the twelve years 1891–1902, and noting the difference between these mean values and the readings of 1902 and 1903. To shorten the table, the mean difference for each month only is given—

TABLE XI.

Month.	Mean difference in centimetres from mean readings of 1891–1902.	
	1902.	1903.
	centimetres.	centimetres.
July	− 79	−18
August	−200	−69
September ...	− 92	+ 6
October	− 57	+27
Mean	−107	− 9

so that 1903 may be considered as rather below an average flood, while that of 1902 was an extremely bad one.

It should be noticed that the volume brought down by the Atbara is included in the Wadi Halfa gauge-readings, but is not included in the Khartum measurements. Probably no great error is introduced, but the volume discharged in 1902 and 1903 by the Atbara cannot be compared, as the 1902 discharges were taken too near the junction. In 1903 the volume discharged between July 16 and October 5 was 11,972·4 millions of cubic metres.

Having thus obtained the relation of a bad flood to a normal flood, it is desirable to get that of a normal flood to a maximum flood, which can be deduced from the Aswan gauge records.

In Table XIII. is given the total volume discharged at Aswan from July 1 to October 31 in the years 1869 to 1900, calculated from the discharge table given by Sir W. Willcocks.* From this the proportion of the volume of the low flood of 1902 to the average flood of thirty-five years is 0·63 to 1·00, a relation not very different from that obtained for the Blue Nile at Khartum; and taking 1878 as a maximum year, we have—

Minimum year. Volume.		Average year. Volume.		Maximum year. Volume.
0·63	... ...	1·00	... ...	1·24

or, speaking in general terms, the volumes of the maximum and minimum floods are respectively about 30 per cent. above and below the volume of a mean flood.

Having detailed the principal features of a normal Nile flood, the variation in its date from year to year, the amount of water discharged in a low flood and a normal flood, it now remains to enumerate the various tributaries which supply the Blue Nile and the Atbara. The information about most of these is extremely meagre, but it is of importance to put together all that exists in order to trace the supply of their flood waters as rains commence in their catchment basins, and the fall of their waters as the rains decrease, for this fall will first affect the rivers draining the northern parts of Abyssinia. As the climate of Abyssinia becomes better known and more observations are available, it will, no doubt, be possible to follow the successive rises and falls of the different tributaries and trace their several effects on the main stream.

The tributaries of the Abai and Blue Nile are very numerous, and only the more important ones need be mentioned here. On the left bank are the following: the Bashilo, which rises near Magdala and drains a large part of the eastern plateau to the south of the basin of the Takazze; the next important stream is the Jamma, which rises near Ankober, and drains a large part of Shoa; from where it joins the Abai, the united streams turn south-west, having at this point a width of 60 to 70 metres and a depth of 3 or 4 metres, according to Rochet; † the Muger rises to the north of Adis Abeba and joins the Abai a little south

* 'Perennial Irrigation,' App. III. Table I. Cairo: 1894.

† Von Klöden, 'Stromsystem des oberen Nil,' p. 202. Berlin: 1856.

of 10° N. lat.; the Guder rises on the north side of the Rogge mountains, which divide its basin from that of the Omo and the Hawash. After these comes the Didessa, which is the most important tributary of the Blue Nile. Rising somewhat south of 8° N. lat., and near the headwaters of the Baro, it flows northwards to the Abai, which it meets just south of 10° N. lat., and in about 35° 40′ E. long.*

Michel † crossed it at two points high up, one 50 kilometres below the ford opposite Mount Deka, to the west of Bilo, and the other at the ford. On June 12, 1897, it was 110 metres wide, of which 40 metres was the main channel, having a depth of 3·35 metres, while the depth outside the channel was 1 metre. The velocity was 1·30 metre per second, so that the discharge was about 110 cubic metres per second. It had commenced to rise on May 25, and fell from October 10; the water was turbid and red in colour.

At the second place a more detailed section was taken on September 13, 1897.

	Metres.	Metres.	Metres.	Metres.	Metres.
Distance from left bank ...	5	25	60	95	105
Depth	2·80	3·55	4·20	4·0	3·05

This gives a sectional area of 392 square metres, and this with a velocity of 1·80 metre per second corresponds to a discharge of about 700 cubic metres per second. At this season its valley was flooded to a depth of 60 centimetres. At the beginning of April, 1898, the Didessa at this same place was only 45 metres wide and 0·45 metre deep.

These measurements were all taken before the Anjur joins it, so that they must be below the total amount which it carries to the Abai. In its early rise, long flood period, and late fall, the Didessa is, in its regimen, very like the Sobat, near the headwaters of which it rises.

As this part of the course of the Blue Nile has been little visited, I give a description of it from the Didessa junction to Famaka, for which I am indebted to Mr. A. Hay, who was recently for some time in this part of the country.

"Just about 2 miles above its junction with the Didessa river, the Blue Nile emerges from a high gorge in a range of mountains. At the end of the hills there is a shallow, rocky, gravel-bottomed rapid, and here the river, hitherto running almost due north, makes a sharp bend to due west. At the end of this stretch, which is about a mile long, the Didessa joins and appears to come in on a course similar to

* Weld Blundell, *Geog. Jour.*, March, 1900. Hughes Le Roux, 'Menelik et nous.' Paris: 1901.

† 'Vers Fachoda,' p. 557. Paris: 1900.

that which the Blue Nile now assumes after another sharp bend to north-west. The Didessa is very rocky, and full of rapids just above the confluence. The Blue Nile now travels about 10° west of north to due west. At the top of this stretch there is a regular cataract. This course is maintained generally down to the confluence of the Durra river, which comes from a course slightly north of east, and at the end of March the Durra carries about 3 cubic metres per second.*

"From the confluence of the Didessa with the Blue Nile down to the Durra river, I reckon it is approximately 23 miles. There are frequent rapids on this stretch of river, and one particularly deep gorge just above a very large sandy khor.

"From the Durra river to the Gojabba river, which in dry weather is a succession of pools, is approximately 15 miles. Due west of Gojabba river, and about 2 miles from the left bank of the Blue Nile, stands Mount Gumbi, and 5 miles further is the village of Yimbi. In this stretch of river there are not so many rapids, although a few of them are very long ones, and the bed of the river is made up of gravel-banks, deposited on rocks.

"Wamboro plateau lies in 10° 2′ N. lat., and about 8 miles north-east of the Blue Nile.

"From Gojabba river to Abu Timbohor is approximately 30 miles, and the general direction of the river is 20° west of north. About a mile below Gojabba is a heavy cataract, and after this, with the exception of one rapid, it enters a rocky gorge, but is deep and flows quietly along. When it reaches the head of Abu Timbohor's villages, it makes a sharp bend to due west for about 3 kilometres, and then resumes a course of 12° west of north, enclosing an island of 300 acres.

"Opposite Abu Timbohor's head village is a large mountain (name unknown), about 3 kilometres north-west of the confluence of the Dabus river with the Blue Nile. About 24 kilometres east lie the Gum Gum mountains.

"From Abu Timbohor to Yaring is a distance of approximately 50 kilometres, and the course of the river is 12° west of north. There are fewer rapids, and the river is rather gorgy all the way.

"The Bellus (Bolassa) river joins the Blue Nile about 11 kilometres above Yaring, which is about 3 kilometres further up the river than Bambok's village."

The river called Bolassa, or Yesien,† was also visited by Schuver in May, 1882, when he marched along the last 40 kilometres of it until it joined the Blue Nile. He describes this last permanent tributary of the Blue Nile as a fine winding stream of clear water which then (May 20) was at its lowest, and without a perceptible current. It lay between high banks of grey granite. On May 22, 1882, the river began to rise

* The letter says "per minute," but this would make the flow almost imperceptible.

† Schuver, *Pet. Mitt.*, Erganz. 72, p. 79. Gotha: 1883.

and the water to become muddy, while the Blue Nile water had become so earlier.

The next tributary after the Didessa on the left bank is the Dabus, or Yabus, which rises in the Beni Shangul hills, and, flowing northwards, joins the Abai where it leaves the Abyssinian mountains and turns northwards towards Famaka. Weld Blundell * describes it as a fine river flowing in a deep valley between hills 650 metres high; it was about 200 metres wide and 1 metre deep when he crossed it at 10° 13′ N. lat. at the beginning of May, 1899.

The Tumat joins the Blue Nile 6 kilometres down-stream of Famaka. It has been described incorrectly as carrying water throughout the year, † but Schuver describes seeing the first water of the flood come down its bed near Jebel Ghezan, on the road from Famaka to Beni Shangul, in 10° 45′ N. lat., at the end of May, 1881.‡ Marno § states that in the dry season water may everywhere be found in the river-bed at a short distance from the surface. All these larger tributaries must bring down a large volume in the rainy season, and most of them contribute a certain amount throughout the low stage of the Blue Nile also, so that the supply in the months of the spring and the early summer depends on them and the Abai itself. The Abai was found by Dupuis ‖ on January 31, 1903, to be discharging only 42 cubic metres per second where it left Lake Tsana, thus the winter and spring supply of the Blue Nile comes mainly from its tributaries. In marked distinction to the left-bank tributaries are those of the right bank; with a steep slope and a short course, they are torrential in character, and rise and fall rapidly, but, after the rainy season, soon fall to very small dimensions. The Rahad and Dinder which rise in the western foothills of Abyssinia, and flow north-west to join the Blue Nile above and below Wad Medani respectively, are larger streams, and are of importance when in flood.

Pruyssenaere ¶ measured the discharge of both of these, as well as of the Blue Nile at Karkoj in 1864, at highest flood, and gives the following values:—

	Width.	Mean depth.	Sectional area.	Mean velocity.	Discharge.
	metres.	metres.	square metres.	metres per second.	cub. metres per second.
Blue Nile (Karkoj)	435·0	7·10	3088	1·90	5867
Dinder (Wold Abyad), 13° 3′ N.	163·4	4·58	746	1·90	1454
Rahad (Wold Es), 13° 19′ 5″ N. ...	83·2	3·14	261	2·05	535

* *Geog. Jour.*, Feb., 1900.

† *Bull. Soc. Geog.*, 1843, **19**, p. 99.

‡ "Reisen in oberen Nilgebiet," *Pet. Mitt.*, Erganz. **72**, p. 1. Gotha: 1883.

§ *Pet. Mitt.*, 1873, p. 250.

‖ 'Report upon Lake Tsana,' p. 19 (published with Sir W. Garstin's report on the Basin of the Upper Nile). Cairo: 1904.

¶ *Pet. Mitt.*, Erganz. **51**, 1877, p. 45.

In 1864 the Dinder was flowing with a feeble current on February 18, and soon afterwards ceased to flow.* They both rise about the end of May or the beginning of June. There are no gauges on either of these rivers, so no more recent data are available.

The right-bank tributaries therefore contribute very little to the low-stage supply; they have for the most part, not only smaller catchment basins, but a shorter rainy season. The left-bank tributaries draining Shoa, Wallega, and northern Kaffa have larger basins and longer rains, so that if the September and October rains are above the average, these streams will supply a larger volume to the Nile at low stage, as also will the Sobat, and, as has already been mentioned, these are the determining factors of the low-stage supply.

Before leaving the Blue Nile, the rate of transmission of the flood wave should be considered. Data for this purpose are not very ample, but they will suffice to form an estimate of the time which elapses between the rainfall entering the tributaries and reaching Khartum. On Fig. II. are plotted the flood curves of the Blue Nile from the gauge readings at Roseires, Sennar, Wad Medani, Khartum, Berber, Wadi Halfa, and Aswan for the flood of 1903, and from them the following data are taken †:—

River at Roseires.	Date.	Days taken for water to travel.		
		Roseires to Sennar, 273 km.	Sennar to Wad Medani, 146 km.	Wad Medani to Khartum, 230 km.
Fell	May 31	3	1	3
Rose	June 4	2	2	3
Fell	„ 12	3	1	2
Rose	„ 25	2	2	2
Fell	July 8	3	2	3
Rose	„ 12	3	1	2
Fell	„ 17	3	0†	2
Rose	„ 27	1	2	2

Mean time Roseires to Sennar 2·5 days, or 109 km. per day.
„ „ Wad Medani 4 „ 105 „
„ „ Khartum 6·4 „ 100 „
or about 10 to 11 days from the centre of its basin.

The last tributary of the Nile is the Atbara, which has been considered by some writers as of almost equal importance with the Blue Nile, while by others it has been thought to be almost insignificant in its effect. If the early rains are unusually heavy, the Atbara will bring down a very large flood; but in years when the late rains are

* The Dinder is not a perennial stream, as stated in *Scot. Geog. Mag.*, 1904, p. 480, except near its source.

† As the gauges are only read once a day, it is not always possible to determine with accuracy the time taken by the flood wave.

the heavier, the Atbara flood will not be so marked, since the rainbelt has moved southwards: 1874 was an instance of the first, and 1878 of the second case. In 1903 the volume discharged by the Atbara from July 16 to October 5 was to that discharged by the Blue Nile for the same period as 11,972 to 50,799, or about 1 to 4·3. It rises about the middle of June, reaches its maximum about the third week in August, and then falls rapidly; from November to June much of its lower course is dry, except for isolated pools. On Fig. III. are plotted gauge curves, for Khashm el Girba 410 kilometres, and for Abadar 30 kilometres from the junction with the Nile for the flood of 1903; at Abadar there was a temporary gauge, which was read daily while discharges were being measured. The discharge, as may be seen from the discharge diagram, Fig. III., varied from about 400 cubic metres per second on July 16 to 3000 cubic metres per second on August 31. The rate of movement of the flood-wave can be deduced from a comparison of the two gauge curves until about August 20; after that the Blue Nile had risen nearly to its maximum, and seems to have disturbed the regular agreement of the two curves for a while.

The rate of transmission of the flood-wave is deduced from the following data:—

River at Kashm el Girba.	Date.	Days taken for water to travel from Khashm el Girba to Abadar, 380 kilometres.	
Rose	July 26	4	Mean time of travel for a rise, 3 days.
Fell	Aug. 2	2	Mean time of travel for a fall, 2½ days.
Rose	,, 8	3	
Fell	,, 11	2	
Rose	Sept. 15	2	
Fell	,, 17	0	
Rose	,, 26	3	
Fell	,, 27	3	

This gives a rate of 127 kilometres per day for a rise, and 152 kilometres per day for a fall. Possibly the difference is illusory, and is due to gauges being read only once daily. In this case the mean value of 138 kilometres per day is probably a safer one to use. If the point where the course of the Takazze turns from north to west be taken as the centre of its basin, then the water from this point has about 450 kilometres to travel to Khashm el Girba, and 410 kilometres more to the Nile. In doing so it falls from about 900 metres above sea-level at this point of the Takazze to about 460 metres at Khashm el Girba, and then to about 350 metres at the Nile. Thus, if it takes 2·75 days from Khashm el Girba to the Nile, we may add about 2·5 days for the rainfall of the middle of the upper catchment basin to reach Khasm el Girba, which will give 5 to 5·5 days for it to reach the Nile.

Having now an approximate estimate of the time taken from the Blue Nile rainfall to get to Khartum, viz. 11 days, and from the basin of the Takazze to the Nile near Berber 5·5 days, these may be added to the times taken by the flood-wave from Khartum to Aswan as given by Sir Hanbury Brown * for July 2 and September 9—that is, the early part and top of the flood.

Beginning of	Blue Nile basin to Khartum.	Khartum to Aswan.	Total.
	days.	days.	
July	11	18	29
September	9	9	18

Beginning of	Takazze basin to Berber.	Berber to Aswan.	Total.
	days.	days.	
July	5½	14	19½
September	5½	7	12½

It is instructive to compare the gauge-curve of Khashm el Girba, representing the drainage of the northern part of Abyssinia, with that of Roseires, representing the drainage of the central and southern part. After June most of the larger rises and falls of the Roseires gauge can be matched by others about the same date on the Khashm el Girba gauge, those of July 30, August 3, August 10–18, August 27–31, September 17–23, 1903, being the most marked. This shows that the rainfall is widely distributed, and varies not locally so much as by a succession of heavier and lighter falls which affect the whole plateau similarly.

(To be continued.)

EXPLORATION IN ASIATIC TURKEY, 1896 TO 1903.†

By Colonel P. H. H. MASSY.

"TOPOGRAPHY is the foundation of history." We read this in Prof. W. M. Ramsay's valuable treatise on the historical geography of Asia Minor published in 1890 under the authority of this Society. The deep meaning of these words is most fully realized in a still primitive country such as Asiatic Turkey, where, as we look upon the ever-varying features which lie before us, unsmothered by modern civilizing appliances, we feel it to be a land of which the topography, as well as the history, is still to-day but very imperfectly understood.

Topographical and historical research must progress hand-in-hand

* 'Report of the Public Works Department, Egypt, for 1902,' p. 184. Cairo: 1903.
† Read at the Royal Geographical Society, June 5, 1905. Map, p. 368.

in such a land. Fresh routes opened up cast new light upon past events before almost incomprehensible, while travel and exploration act as a keen incentive to the historical study of regions traversed. Atoms of information gathered by successive travellers may, when pieced together, lead to valuable knowledge. That fact, and the hope of inducing others to follow in our steps, are the chief *raisons d'être* of this evening's paper. Time only admits of very cursory reference to many notes taken during nine years of residence and of travel in most parts of this Asiatic peninsula. The map shows the outline of the chief routes traversed, some of these passed over several times. Gratitude is felt to this Society for valuable instruction and for the loan of instruments. Also to all Turkish officials for their courtesy and aid, and to the population generally, whose proverbial hospitality is not in the least exaggerated. It is hoped that a discussion will follow in which gentlemen present may be so good as to take part to bring forward fresh points of interest.

The first difficulty which confronts the traveller is the want of a good map; none reliable is available to the public. To Kiepert we owe thanks for placing something in our hands and for an effort now being made to gradually correct that something. It is not to criticize that map, however, but to encourage other cartographers that I say how much there is yet left to be noted and corrected. It would be very satisfactory if we could encourage well-equipped and well-taught volunteers to go out more and more and to systematically map Asiatic Turkey by sections. Kiepert's new sheets are somewhat involved by a mixture of ancient and modern names. Indeed, the alterations take more the form of archæological additions than of modern topographical correction, perhaps because the information has been chiefly furnished by archæologists who have lately travelled more than the modern topographer. If the opinion may be offered, it would have been better had the modern been kept entirely separate from the ancient; had an entirely new map been built up gradually as reliable topographical information could be gained. It is only fair to add, however, that very great difficulties exist in that land to obtaining any information whatsoever, the first of which may be the want of knowledge of the language. It requires an exceptionally fine ear to catch a name mumbled out fast in a strange tongue. Geographical names are based on everyday objects: the "forty-ford" stream, the "grey-blue" stream, the "thousand and one churches" mountain, and so on. If you know the sense, it is easy to spell the word, otherwise it is often difficult to identify the place from the misspelt map. We have all suffered in Turkey from these mistakes, and they are some of the least important. But when the imaginative traveller puts down a village close to a road when it is in reality a mile or two off it the consequence may be a night passed out in the open, with neither shelter nor food, if you trust to your map for the hoped-for lodging. Mr. H. F. B. Lynch's map of north-eastern Asiatic Turkey is a great advance on what has been before published, compiled with the greatest pains from very reliable sources and with great personal knowledge of the country. Let us hope that before long this valuable work may be extended.

But even upon Mr. Lynch's excellent map there are some routes not marked which I followed, and as an example of some of the difficulties which beset the mapless traveller let me tell you some of my experiences of travel between Erzerum and the Persian frontier. Starting from Erzerum, in the autumn of 1899 with my usual followers, a cavas, two servants, a Government zaptieh, and my baggage animals, I was determined to explore an alternative route to the usual caravan road to Van, which I had reason to think existed although it was never followed by travellers; this intention I concealed from the governor who might have attempted dissuasion. At Ertev the zaptieh was sent across to Hassan Kale for another warrior who should know the country to the south of the usual caravan road generally. When he arrived his appearance was not very awe-inspiring, some seventy years of age and evidently nervous. We never could pass such a way, he said, through a district of lawless, savage Kurds, where he certainly knew no road. We started, nevertheless, I promising protection to this arm of the law. I must here add that the zaptieh is generally a most useful, willing fellow, who assists greatly by his presence on the march. It proved to be a most interesting journey. For six days we journeyed on with nothing to guide us but compass bearings which showed the general direction towards Van. No Turkish official was seen as we passed through the territories of some eight very independent and warlike tribes of Kurds—the Kazkanli, Zirekanli, Sipkanli, Jemadanli, Zillanli, Hassananli, Berezanli, and the famous Haideranli—who either dwell or pass the summer in these parts. I must in gratitude say that to me all proved to be courtesy and hospitality itself in their kind reception.

From Hassan Kale to Arjish, or Aganz, on Lake Van, there exists no sign of government; the chief of each tribe is a law unto himself. It is only inter-tribal animosity which literally keeps him within bounds and prevents these Kurds from becoming an unmanageable force. A few tribes may combine but they are certain to be opposed by others to hold them in check. They now form Hamidie cavalry regiments; the sons of big beys are sent to military schools at Constantinople: it is hoped that greater civilization will follow. It is an interesting theme too long for our present time limits.

The plan of orientation on the road adopted was, as already said, compass bearing, as a check, on Arjish, towards Lake Van, and then to follow the best road available from village to village, or nomad camp to nomad camp, along that bearing generally. At night, half blinded by the smoke of a chimneyless fire kindled in the centre of the best room of some Kurdish cabin, surrounded by the whole village, topographical notes would be amplified by questions as to the names of villages, streams, or hills passed that day. In the morning an escort of twenty or more dashing cavalrymen, mounted upon every description of ragged, half-starved beast, and firing "furious joys," or *feux-de-joie*, into the air, and sometimes into each other's faces, led us on our way a certain distance to put us on the right track. It is small wonder that these demonstrations proved too much for my "escort." My old zaptieh pleaded sickness, and begged to be left at Arjish, the first oasis of Government civilization he met. I readily consented.

Within the limits of each tribe it was not difficult to follow the

ARARAT, FROM BAYAZID PLAIN.

road, where all were eager to be obliging. But across the borders no one dare accompany us, and then it was only by following instructions given on the tribal boundary that the next village or camp could be found. In this way an excellent route was traced where wheels could pass without difficulty, the only steep gradient being the first rise from the Araks river. But as Government posts are not established caravans make a *détour* north. They do not want Turkish officials; my poor zaptieh could never pass here except with a foreigner or a very powerful armed force.

The chief topographical feature of this route is the Araks river south-east of Ketivan village, flowing east to the Caspian sea; it is about 35 yards wide where crossed, generally fordable here in summer.

Crossing it to the east we immediately ascend the somewhat steep slopes of the western extremity of the Sharian range which forms the watershed here between the Araks and Euphrates systems. The road goes up gradually, being steep only towards the top, yet carts could pass up zigzag. A few villages are dotted here and there in patches of cultivation, but trees, as everywhere else in Kurdistan, exist only near the rarely seen villages. At ordinary slow caravan, uphill pace of 3 miles an hour, the ascent occupies an hour and a half. The country traversed, generally, after this rise is an open, undulating, treeless plain, with occasional valleys and small streams and hills, no great obstacles. We cross diagonally the Kara Yazi, Kazbel, and Torlu uplands, towards the south-east, on a bearing towards the northern flank of the great Sipan mountain, a good landmark ahead. Villages are met with here and there but the population is sparse, and cultivation exists but to supply the wants of the people, there being no paying means of transport; the higher tracts serve as grazing-grounds round summer encampments. The general height of these uplands may be reckoned at 7000 feet, gradually falling to the Murad Su, or Euphrates, to the south. This river we reached to the east near Karaghil village, here about 150 yards wide, sometimes fordable, though a ferry plies; height here about 5000 feet, we having started at 6250 feet at Erzerum.

An intertribal fight witnessed was not the least interesting episode of this journey. Some flocks were being driven off across the Sipkanli Kurds' border when the usual alarm signals, shots fired and smoke fires kindled at all the villages around, brought clouds of horsemen galloping wildly across in that direction. This did not look very reassuring in the middle of so wild a country where a human life is never worth that of a good sheep, but we soon perceived, by the yelling Kurds with grinning faces who dashed past us, that to us no harm was intended. We reached the village not far from which the battle was raging to find the flat roofs occupied by all the women, who, quite regardless of stray bullets, followed the fluctuating fortunes of their side amid the din of their own shrill tongues, which almost drowned the thundering reports of the anything but noiseless or smokeless Kurdish powder. It was soon over, the flocks triumphantly brought back with the bodies of a few dead Kurds and some others wounded. We passed on amid the wailing of the women just widowed in a fight for a few sheep.

The landmark which for so long has been a guide far ahead—the great Sipan Dagh, an extinct volcano said to be about 13,000 feet high—looks now to be close to us, although a long distance off yet, south-east, on Lake Van. It is a most imposing mass rising from the plain which we are now crossing to the south-east of the Euphrates. We join the regular Erzerum—Van caravan road not far from this river and pass through Patnoz to Arjish and on to Van.

The latter part of the journey to Van and my subsequent march to the Nestorian country and visit to the Marshimun at Kochannes call for no special remark, these parts having been already so admirably described by Earl Percy. I will only say that in 1899, during my visit, the late Marshimun was still living and I found Kochannes quite an oasis on this rough and, one may say, dangerous march. We were entertained not only hospitably but charmingly by the old man and the Rev. W. H. Browne, who resided there, as well as by the present Marshimun and his sister, the latter a very attractive girl who spoke English perfectly.

From Kochannes a route north was followed by Bashkala and along the Persian frontier through very wild country with no apparent signs of lawful government, or indeed of anything much but of Kurds and stones, as far as Bayazid and Mount Ararat, at a point where three empires meet. On this road, to the south of the volcanic Tendurek Dagh, which has scattered great masses of lava for miles around, my Lee-Metford eleven-shot sporting rifle attracted the most covetous envy, one rich chief offering me untold gold and several good Russian rifles in exchange for it. I was not waylaid, as I expected to be, that evening after my refusal to part; and, indeed, I was denied all excitement of attack wherever I passed through this curiously interesting country. As no prominently high mountains are passed in this march north as far as the Tendurek Dagh, close upon 12,000 feet, the general impression given, in following roads but little less than 7000 feet in general altitude, with considerably higher points all around, is that the eastern limits of Turkey in Asia are not so elevated nor so difficult as many other parts through which we have passed. The road followed was not a difficult one for such a country and easy communications led across into Persia where the inhabitants were quite as friendly as on the Turkish side in the few cases where my way led me through their villages.

From Bayazid, 6700 feet, and Mount Ararat the main road was not taken to Erzerum by Kara Kilissa and Diadin, 6400 feet, south of which, in the Ala Dagh, rises in several streams the Murad Su—the eastern branch of the Euphrates. The northern side of this valley, hugging the Russian frontier, was followed by an easy track, with gentle gradients, as far as the Baliklu Geul—the "Fishy" lake—a not very large expanse of water full of fine trout, about 7400 feet high, surrounded by the mountain peaks of the Sinekle Dagh. Carts could pass anywhere on this road while at several points easy passages lead into Russian territory towards Erivan, Alexandropol, and Kars. The general height of the plain at the southern foot of Mount Ararat is about 6000 feet. All this country played a historic part of great importance in the Russo-Turkish war of 1877-8, when Bayazid fell to the Russians. A low ridge of hills, running from this lake south-east to Diadin, is of great geographical importance in forming here the watershed between the Murad, or Euphrates, and the Araks rivers—the watershed between Mosopotamia and Central Asia, one may call it, in these parts. It is, indeed, interesting to think how the little parcel of earth forming here this low parting may have changed the history of south-western Asia by forcing the mighty Euphrates, at its source, towards the south from its natural course to the Caspian. The magnificent view as one follows round the base of the majestic Ararat, towering 10,000 feet and more above the plain, yet so impressively massive that it hardly represents its height of 17,000 feet, is one which well repays the traveller.

It was now October. A blinding snow with bitter wind served as reminders of the altitude and advancing season. From the lake a route was followed to Toprak Kale (Alashgird), not so good at first in descending as that traversed in the ascent and not practicable for wheels until the plain level is reached when it becomes good. Along here, also, fairly easy tracks cross into Trans-Caucasia, once the high and craggy Sinek Dagh are passed, as the mountains are called west of the lake, not Egri Dagh, as I see on some maps, which is the name exclusively reserved in Turkish to the Ararat group. It was here that an official asked my opinion of a nice Smith & Wesson revolver inscribed as presented to Frank Lenz by some American bicycle club. I returned it with the remark that it was a good revolver which might hang him. His companions looked at him curiously while he appeared visibly agitated. Frank Lenz was murdered near here a couple of years before while on a bicycle tour round the world and I knew the story. Up to now this individual was under the impression that the inscription was either the maker's name or an ornament. I crossed the Araks river close to where it enters Russian territory, returning to Erzerum again by the Passen plain and usual route. Many of the roads traversed are not marked on the existing maps and the difficulty may be imagined of tracing a way through such mountainous districts, in many parts depopulated, with no guide but one's instruments and an idea of the right direction.

Many routes followed might be touched upon, and with special interest in those parts north-east of Erzerum towards the Black sea through Lazistan. An account might also be given in detail, did time admit, of a journey to the source of the Kara Su, or western upper Euphrates, where, at a height of over 10,000 feet, it bubbles up from the mountain-side on the summit of the massive, undulating-topped Dumlu Dagh and flows down at once a considerable stream full of trout. Turning from the pool-source to look down from such an altitude upon this stream as it winds its way across the Erzerum plain westwards, to become, in the plains of Mesopotamia and towards the Persian gulf, the great controlling river of so many historical and political events, the thought forces itself upon one that topography is indeed the foundation of history.

Like most similar spots the source of this great river is looked upon as a holy place, or "ziaret," by the Turks who offer sacrifices here on occasions; I assisted at such a ceremony. There is a story generally told in these parts how the Crusaders defended here the real cross which they were bringing back from Jerusalem, although nothing is added to explain why the Crusaders should have been crossing 10,000 feet up in the mountains; but it is interesting as showing how these wild tribes have carried down some hazy tradition of the passage of these warriors. It is interesting, also, to remember

TYPICAL KURDISH VILLAGE.

that the Ten Thousand passed not far from this spot. The Christians sacrifice sheep and goats here, and assemble from great distances around, at times, in pilgrimages.

There is but time left, before we cross down to the Taurus, to say that the frontier-line up north from here as far as the Black sea is generally difficult, intersected by fairly high and rough mountains, with no well-marked passages for roads. Wheels could not at present pass. But up the Kara Su valley, north-east, and towards Olti and Kars on the Russian side, easier passages exist. It is surprising over what country the local bullock or buffalo cart will travel; they went easily to the source of the Euphrates, and could pass over most of these southern parts, the mountains being round-topped and not rocky.

The country to the south of Erzerum, including the Palan Duken, or "Falling Pack-saddle" ridge, so called as it used to be very steep before the present good military road was made, and the Bingeul, or "Thousand Lakes" mountains beyond, a beautiful group, is most interesting. Leaving all description of the better-known routes I shall only allude to one which leads up the valley from Khunus to the north of the Bingeul Dagh and across the fairly easy country to the western end of the Palan Duken or Eyerli Dagh ridge. In this direction an easy road rises gradually to this ridge, passing a few villages where towards the end of winter supplies for both men and horses are scarce. The road rises to a pass above the Government salt-works which lie just north of the ridge at an altitude of close upon 9000 feet, then dividing into three tracks towards the north—to Erzerum, Ilija, and Ashkale respectively. Very little labour would fit this road for wheels and it is an alternative route to the Palan Duken pass well worth noting, one not traversed by many other Europeans. From this ridge the Bingeul mountains, from the thousand little lakes and springs in which the Araks river takes its source, form one of the most striking groups, cut up in every direction by deep ravines and crevasses formed by the melting of centuries of snow and ice; in winter as forbidding an abode as in summer it is a very paradise for the wandering nomad and his flocks. On all the roads followed abundance of water is as a rule available. It is one of the delights of the wild life associated with travel in most parts of Turkey-in-Asia that inviting streams and springs follow or cross one's path incessantly; indeed, water absorbs the place in conversation in that country which health does in this. The Turk is quite a judge of water as far as "lightness" and "heaviness" are concerned, that is, its digestibility or otherwise, although he cares but little what microbes or fever germs it may contain. As a rule the water is pure and excellent almost everywhere.

The most marked feature of all this Eastern district is the entire absence of wood, not from any natural condition as trees would evidently grow in most parts, according to species and to altitude limits, but owing to wilful destruction and neglect to replant. Firewood now comes four and more days' journey to Erzerum and is in that city the most expensive household necessity, while across the border, on the Russian side, there are magnificent pine forests. This regrettable destruction extends all over Asiatic Turkey, square miles of forest being burnt where as many square acres of clearing near some village are desired. Around villages great walls of magnificent logs rise up and around fields also, so that soon no forests will remain except in the most inaccessible mountains.

A word regarding the climate and seasons in Kurdistan may be of interest. The winter is naturally cold and rigorous at an altitude which may be reckoned between 6000 and 12,000 feet and much snow falls in early November, burying everything for close upon six months during which nothing moves; men and beasts share the same semi-underground mud hovels where supplies are laid in. That is a short season; the snows melt, much rain often falls and then succeeds an almost tropically hot summer. Crops ripen early under the burning sun. Summer and autumn are the proper marching seasons, when supplies are abundant and roads in good order.

We now cross to the south-west, to the Taurus mountains and the surrounding country where questions of much topographical and historical interest await solution by future explorers. Let us consider the river system of Asiatic Turkey. A peculiarity which all the

THE SOURCE OF THE EUPHRATES, DUMLU DAGH.

greater rivers have in common is their considerable volume from the very source. The eastern branch of the Euphrates is a fine river as it descends through Kurdistan from the Alashgird plain, near where it rises; while the western, if not so great, is already a good stream as it passes below Erzerum to join the first-named above Malatia, there to force a joint passage through the final bulwarks of the main Taurus, the only river except the Tigris which flows south from this middle-eastern part of the chain. An interesting paper by Mr. Huntington, in the *Journal* for August, 1902, describes this passage; he raises a point of interest on the Anti-Taurus range. On p. 179 we read, "North of the plains" (evidently here the Malatia plain has been alluded to) "lies the southern half of the Anti-Taurus mountains, in which may be included the great Dersim range." Here is a description of the Anti-Taurus quite strange to us who have seen this range displaced in descriptions, but generally assigned a position around the upper stretches of the Sarus river, or modern Seihun. I shall refer again to this presently.

Between the two Euphrates branches the Araks issues forth from the Bingeul Dagh, a fine river escaping north-east to the Caspian. These erratic courses suffice alone to give an idea of the complicated mountain systems of these parts.

If we except the Kizil Irmak, or ancient Halys, which drains the northern part of Central Asia Minor to the Black sea, the only other rivers of any importance are the Jihan (Pyramus), Seihun (Sarus), and the Tarsus river (Cydnus), which all descend through or from the Taurus to fall to the Mediterranean through Cilicia. I do not mention the Orontes, a fine river at Antakia (Antioch) but whose insignificantly short course is only an overflow from the lake a short distance above; nor the Calycadnus, or Geuk Su, at Selefke, more historically than topographically important.

The Jihan, or ancient Pyramus, rises a mile south-east of Albistan in a series of springs, alive with splendid trout; so great is the volume already at the very source that there are many mills above the town, and the river flows through it in two branches which form an island. It is joined close to Albistan by the Sogutle stream from the east. Strabo tells us that in olden days the Pyramus was navigable as it crossed the Albistan plain. I can believe it, it is so deep and still; but it would be for a short distance only as soon after the junction of the Khurman and Geuk Su streams the Jihan enters mountain glens and forms a very rapid river until it issues into the eastern end of the Cilician plain to the north of Osmanie.

The Seihun, or ancient Sarus, rises in two branches, both considerable at source—the Geuk Su, rising not far east of Azizie; the other, the Zamanti, to the south of Sivas and crossing the Uzun Yaila—fine rivers uniting some 40 miles to the north of Adana town, and receiving the Chakut stream 6 miles above that place. Prof. Ramsay has made this junction below the town (*Journal*, October, 1903, p. 385), but this can be but an oversight or slip. The Chakut, which we shall find again presently north of the Cilician Gates at Bozanti, has been joined a few miles above this junction by the Korkun Su, an interesting stream which has flowed down from the east of Nigde, cutting its way through the various ridges of the outer Taurus in short but deep cañons, while draining these mountains from the high Ala Dagh (the Red Earth mountain) to the sea. On these streams timber is floated down in rafts. I travelled down the Korkun for some distance on such a raft, reminding me of a similar experience on the much larger Cabul river in Afghanistan, and down as far as Adana through the Chakut and Seihun, a pleasant mode of travelling, exciting as we shot the rapids at every bend. The Seihun is easily navigable for light-draught steamers from above Adana to the sea, but none come up.

The Cydnus, historically the most interesting of the Cilician rivers, has not a long course. Rising on the south side of the great Bulghar Dagh it works down a large and beautiful stream, abounding in trout from its source, through a comparatively easy course to the plains north of Tarsus. A central arm joins it from the north, while the eastern branch is the stream from the Cilician Gates which falls to the Cydnus

CAMP NEAR SOURCE OF EUPHRATES.

some 15 miles above Tarsus. To that branch I shall allude again presently.

A peculiarity of these three rivers is the change of direction of their lower courses towards the sea which was rendered, indeed, easy at the time by the very low level of the Cilician plain and its comparatively recent formation towards the coast. I traced the depression from north-east to south-west where the ancient bed of the Pyramus evidently passed, in many places very marked still to-day, from the present Jihan, a little north of Yakshi ferry, to the marshy ground west of Karatash, the ancient Mallus. At this point is another depression coming from the north-west, in which to-day lies a salt lake, with a small opening to the sea often choked with sand, stretching as far as Merkez, the

Government salt depôt, and several miles wide. Around it are marsh and reeds, the winter home of the only real villageless nomads (Turkmans), whom I have seen so far west; they dwell here in reed huts, grazing cattle and donkeys. This must evidently have been an ancient bed of the Sarus meeting the Pyramus close to Mallus.

It is difficult to see how Mallus can have been an island, as Sir Charles Wilson suggests (discussion on Prof. Ramsay's paper, *Journal*, October, 1903, p. 410), because a ridge of hills runs up to it and around it from the present Jihan bed on the east. The modern Karatash lies at this point below the cliffy extremity of this range upon which the lighthouse stands. The remains of the breakwater of the ancient harbour are visible as well as large blocks of stone and pillars lying all around. There is abundance of water, said to be very good, which even comes bubbling up from the sands around the bay. To the east, and south of the ridge of hills just mentioned, stretches a low plain, marshy in parts but gradually coming under cultivation, now one of His Majesty's farms, and a very paradise for the sportsman. The following short extract from my notes taken in November, 1901, is of interest regarding the Pyramus bed :—

"At 8¼ miles from Bebeli ferry" (on the track north-west, Bebeli to Adana) "Kizil Takhta village lies close to our road: fifty houses, three hundred inhabitants (Turkman tribesmen). At a mile, slightly north of east of this village, is Ak Diermen village, on the right bank of the Jihan flowing close here. Our road bends north-west at Kizil Takhta, and at 9½ miles from Bebeli ferry we cross the ancient bed of the Pyramus river which ran here south-west towards Karatash. It is now filled up but forms a wide depression, a marsh in winter. We cross a quarter-mile in shallow rain-water; to our left (west) a small farm and ruin on hillock. Yakshi ferry is seen 2½ miles to our east; then follows Egri Agach Kieli at 11 miles."

This would have been the natural course, south-west from below Missis (Mopsuestia). Was it with artificial aid, perhaps with intent to drain the Aleian fever swamps, that this river was turned off south, so that to-day, by the filling of its delta, it has taken an easterly course to the south of Ayas bay?

From Karatash, which my note-book marks as a fishing and small trading port of 1400 inhabitants, chiefly Fellah Arabs, Merkez lies 18 miles north-west towards the Seihun river. At this point I again refer to my note-book of the same date: "The sea-coast comes close to village of Merkez, 1½ mile off it. The country around here and south is marshy, with good soil farther north under cultivati n. The Seihun or Adana river used to enter the sea near Merkez, coming from Narkulak, Tuzgui Su to Merkez, and then flowing past Sarmesak and Taput to the sea at Zacha Bogaz. Another branch used to flow from Kuransher and, after winding, entered the sea as above. These ancient beds are still easy to trace, the depressions forming marshes." In these parts it is very marshy still to-day and floods from the Seihun cause great damage to crops in wet years. This marshy state continues across as far as the present Cydnus bed, beyond which to the west we have the Tarsus marshes, the ancient Rhegma. The centre of this marsh is very deep; springs bubble up, and great blocks of cut stone are seen in this clear water. Here was the ancient port of Tarsus, not far from the sea of to-day. The depression of the old Cydnus bed is easy to trace. It was probably a fine waterway which led up to Tarsus and through which large ships might pass. To-day fair-sized sailing craft ascend to the modern town occasionally, the volume of

HEIGHTS ABOVE THE CILICIAN GATES.

the Cydnus being considerable except in dry autumn. Two thousand years ago these rivers were swollen with more abundant streams formed by increased rainfall in mountains densely wooded, where to-day the goat and fire have left bare the greater part. In those days Cilicia was a garden covered with fruit trees, beautifully irrigated. To-day Cilicia is God's fertile land, from which man takes all he can but returns nothing.

Before leaving the plain let us cross once more to the east and consider the ancient road which led from Adana by Missis to Issus. This road descended from the Cilician Gates at Sarishekh, gradually, to the south-east, and, following not far from the Chakut river, probably (its track is lost in the soft plain) reached Adana, a town prominent at all times owing to its position on a conical, low hill in the plain close to the right bank of the Sarus river.[1] I have followed this road from Sarishekh and it is still paved in the descent but no doubt with stones renewed as they do not impress one as the ancient blocks. Across to Missis two high mounds divide the distance, used in ancient times as signal or guard stations. The interesting part of the road commences across the ancient Pyramus from Mopsuestia, or modern Missis, at the point where it crosses the eastern part of the Jebel-en-Nur by a passage in which the ancient roadway is still seen. It enters now the Hamidie plain which it crosses to Kurt Kulak, there being at one point a ruined bridge over a now dry watercourse. There are remains and great blocks of stone at several points passed. Proceeding south-east we descend the low hills and pass the ancient gates known as the "Cilician Gates" of the Issus plain, now called Demir Kapu, the ancient way turning now more east and reaching the ruins of evidently a very large city, to which a fine aqueduct led from the east, which then passed westwards to Ayas. These ruins are now covered by low trees, undergrowth and brushwood. They lie to the north-east of the extreme corner of the Gulf of Alexandretta and under the hills to the west of the Amanian Gates. A stream passes down from that direction to the sea, and a deep marsh follows the coast south for 10 miles, 1 to 1½ mile broad, bordered towards the sea by sandhills, to the east by low hills. Close south of this is a conical hill, now a police observation post, in ancient days the site of some town, and in all probability of Issus. Ruins in the shape of blocks of stone are all around this neighbourhood. The present marsh would have been a protected inlet or harbour in which perhaps Cyrus' ships found refuge. The distance from this point to the Syrian Gates, to-day Merkez, about 13½ miles, corresponds very fairly with the 5 parasangs mentioned by Xenophon when Cyrus marched from Issus to the same point. This position appears to be in accord with all evidence, and in examining the country carefully it is difficult to discover any more likely site. The ruins alluded to just now to the west of the Amanian Gates might well be those of Epiphaneia.

We must all agree with Sir Charles Wilson's opinion, expressed in his notes on Asia Minor (*Proceedings*, June, 1884), which, if not the most recent, are amongst the most valuable records we possess, that the ancient Pinarus stream is the one which, issuing from a deep cleft in the Amanus range, crosses the plain here in a somewhat narrow part and falls into the sea at the modern Payas, the ancient Baiæ, to-day a large Turkish convict prison well worthy of a visit. For future travellers the entries in my note-book are interesting that close to the Deli Chai, not far from the point where I place Issus, is an ancient bridge in a dry field, showing that the stream has slightly altered its course, and that on the coast, 2 miles south of the Karanlik Kapu, or ancient "Cilician Gates," is a small sheltered bay with remains of ancient quays, an old castle and other ruins.

In reading the history of Cilicia, we are struck by the predominant part played at all times by sea-power in connection with that country; command of the sea meant general supremacy, and topographical considerations make the reason clear. A force based upon the sea could alone effectively hold this rich plain, with the sea on one side, a high mountain barrier with few passages on the other three. History furnishes scores of examples. In the first century B.C. we find the whole Government system of several provinces disorganized, because the pirates held command of the sea along the Cilician coast. In the march of Cyrus with the Ten Thousand, he having command of the sea and Artaxerxes' troops holding the Syrian Gates at the narrow passage between the Amanus mountains and the sea just north of Alexandretta, Cyrus threatened to move his troops down the coast by sea from a point near Issus to turn the gates and take the enemy in reverse. The result was victory, the enemy retreating.

The same geographical conditions hold good to-day; to the east and to the west of the plain, near Alexandretta and Selefke, the mountains come down close to the sea, turning the only possible passages for roads into defiles.

The chief interests of the Taurus chain still centre around the ancient and beautiful Cilician Gates pass. Historical arguments connected with it are still often based upon imperfect geographical knowledge, however, and errors naturally result so that many interesting problems remain yet to be solved. But we are by degrees approaching facts and our successors will shortly reap a rich inheritance.

Prof. Ramsay concludes that Cyrus descended through the Taurus along a route following generally the direction of the Chakut river, and did not take the Cilician Gates road from Bozanti (Podandus) to Tarsus. On p. 388 of *Journal* of October, 1903, we read, "Cyrus climbed the mountain" (the outer or southern Taurus slopes are here referred to, evidently) "where the stream" (the Chakut) "goes under it, descended the other side, and was then obliged to follow the river for some distance, and at last turned away south-west to Tarsus. In this way he would have about 60 miles' march to Tarsus after he had descended into the low ground from the mountain." As all this section of the Taurus was carefully studied by me for topographical purposes during a journey in June, 1903, the following remarks, which are based upon copious notes taken, may assist us in clearing up this and other points.

The route followed by me was from Tarsus eastward to Yeniji, a station on the Adana railway, a fraction under $9\frac{1}{2}$ miles. The post from Konia to Adana comes down to this station and we shall meet its route again further north. Leaving Yeniji at 4.20 a.m. on June 23, my notes show that the track followed led slightly west of north (bearing

350°) up the valley of the Koja Dere, rising slightly, sometimes dry, at certain seasons a torrent, and over two easy cols at a height of 800 feet, passing an interesting old castle, the Kutukle Kale to our right, the Kiz Kale castle lying off to our west. At 15¾ miles from Yeniji we cross the road which passes here from Adana (south-east), up the Chakut river valley, to Sarishekh and the Cilician Gates to the west. At 19¼ miles, always on the same general bearing and having come an easy path through cultivation and low limestone hills, we reach Polatle, a small village of twenty houses, height 1300 feet, at the base of the southern slopes of the Haider Dagh, the name given to all this outer ridge of the Taurus range from the Chakut river to Sarishekh and the Cilician pass.

It is here that the plain ends and the mountains commence. We are now $9\frac{1}{2} + 19\frac{1}{4} = 28\frac{3}{4}$ miles from the centre of Tarsus by a very circuitous route. By a direct and just as easy a way it would not very greatly exceed 20. We are close to the right bank of the Chakut here, which flows within sight in the valley to the east. I do not therefore see any topographical reason why the ancient road to Tarsus or Cyrus' march should have gone round some 60 miles after descending into the low ground from the mountains, which end here very distinctly at Polatle and at the point close east where the Chakut enters low hillocks on the north of the Adana plain. My notes show that from Polatle a rather steep and very stony ascent leads to Alchak Gedik, the "Low Pass" village, on a col 1800 feet, with no water close here. This is the outer Taurus wall. Do not let us lose sight of the fact that some of Cyrus' light troops had crossed the Taurus from the north-west diagonally towards Tarsus, and that the news of the approach of these troops, as well as of Cyrus' fleet, caused Syennesis to abandon his Taurus defences. It is hardly conceivable that Cyrus would have made a *détour* 60 miles eastwards, thus allowing the enemy to wedge in between his army and the troops he was expecting to join him from the west.

From Alchak Gedik we cross into the Chakut valley, here called the Giaur Dere, and continue now on a bearing 350°, the track descending gradually. There are some old castles here and there, as in most parts of the outer Taurus. The country is intricate with no trace of an ancient road. Rising and descending, the highest point crossed being 2000 feet, we reach the point where the Chakut passes underground, the "Earth bridge," Yer Kupru, as it is locally called: height of river here, 1100 feet; distance, estimated in miles over a mountain track, being $10\frac{1}{2}$ north of Polatle. This passage under the earth is nothing more than an ancient landslip, which has covered the river for a length of from 180 to 200 yards, forming a bridge of earth and rock some 15 to 20 feet thick, and 40 feet over the stream, upon which trees now grow. The bearing of the stream below is 150°; above it is 235°, through a very narrow, precipitous valley, with pine forest overhead. No path leads up this narrow gorge, steep rocks reaching to the water's edge. There is no sign of anything but goat-tracks around and these lead over the surrounding mountains 6000 feet above. I remained once for a week in this valley with the German engineers who were making the tracing for the passage of the Bagdad railway extension, and I passed in every direction over these rugged and precipitous mountains in pursuit of ibex. The engineers could only move as they cut a passage for their feet in this rocky glen and no ancient route appears to have passed through it. Tracks crossed the mountains at all times,

NAMRUN.

no doubt, but none to tempt an army from the natural Cilician Gates direction.

In order to get out of the valley from the "Earth bridge" and to reach Bozanti a very difficult march must be faced where lightly laden pack-animals can scarcely follow. Moving up the valley north-east we gradually ascended to a height of 4500 feet, making a considerable *détour* to avoid the steep cliffy sides of the valley more west. Here we crossed a pass and descended to a tributary of the Korkun Su, a descent of 2000 feet; up again to another col 4000 feet; down again, and again up to 4300 feet to Ekejik, a woodcutters' yaïla, or summer village, continuing up to 4900 feet, finally descending north-west to the Chakut valley in the Belemedik district, that river being crossed at 2200 feet. If this stream is not swollen the valley can be followed north-west to Bozanti by crossing several times in the water, generally very deep. This was not possible at the end of June when I travelled and only by good luck were we not washed down at the ford where we crossed. We had to ascend the western mountain ridge to a col 4000 feet, to the east of Anasha, and then down through that village to Bozanti, height 2600 feet at the stream-level. At the end of this march my pack-animals were all but dead; yet this was the easiest route to Bozanti! Had a track over Anasha to the west of the Chakut been found and followed no less difficulty would have been experienced. I maintain that there is no way here except over high and difficult mountains and if Cyrus chose this route he did so with some deep and unapparent object. Distances also fit in no better than by the Gates.

Instead of Cyrus passing down the road at the Gates, is it not more likely that he took the route crossing the easy plain from Tekir col south-west and, leaving the Gates to his left, skirted the massive heights which stretch westwards from the Gates, and down the valley which leads here straight on Mezar Oluk? This is the Shahin valley. My note-books tell me of splendid camping sites, with abundance of water for troops, and of the advantages of the road with easy gradients and a low col 4500 feet high to the south-west corner of the Tekir plain. This road could be easily made passable for wheels to-day. Indeed its topographical advantages lead one to the conclusion that in ancient times the passage of the road through the narrow "rock gates," and then down a difficult defile south, was made purposely for the purposes of defence, the easy passage round to the west just referred to being, doubtless, carefully guarded and blocked. I personally lean towards the idea that Cyrus passed down the usual road after the enemy had retired owing to the turning movement led by Menon from the west, and the heights alluded to which were climbed would be those to the west of the passage, which are comparatively easy to reach, those to the east most difficult. It might have been quite possible from here to see the tents of the troops who had been guarding this line previously, and other heights lie again to the west and farther south. If the defence was suddenly abandoned, as it appears to have been, tents could hardly have been removed. It is probable, therefore, that Cyrus' army passed both through the Gates and over the heights. (Let me just add that around and on the Tekir plain, north of this passage, Ibrahim Pasha's defences are still in very good order. I counted a considerable number of cannon lying about in the autumn of 1902, and noted their marks, some having the broad arrow and crown. I made Tekir col 4200 feet; Major Bennett and Colonel Stewart say 4300 feet, Ainsworth 3812 feet, Oberhumer 4607 feet, Prof. Ramsay 4240 feet. We may fix it as not far from 4250 feet.)

But whether Cyrus passed by the Chakut valley or the gates or by a route west is hard to decide by reasoning based upon distance which starts from a point not yet fixed. I maintain that in the present interesting case this fixed point is, as in every other case in such measurements, the last one mentioned, here Tyana or Cyrus' camp in its neighbourhood. We must read Xenophon's description of the events as a whole, and not dissect it in order to take his distance of (25) parasangs as beginning after reaching the Cilician plain. No point can be found to fit in with this latter theory unless a march round almost to Adana be supposed before the final advance on Tarsus commenced, which is obviously improbable. While at his camp near Tyana the messenger reported to Cyrus that the defence of the Gates was abandoned. Why should he not take that route, then, and by what other could his chariots

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pass? We read that he ascended the mountains and saw the tents. These he could not have seen from the Chakut valley. He descended through a large and beautiful plain 25 parasangs to Tarsus. This may well be taken to mean that while descending through this plain his march was that total distance, but not necessarily all in the plain. In fact it would be his four days' march from his last point—his camp near Tyana.*

Prof. Ramsay makes the shortest route Tyana—Tarsus fully 95 miles. Murray (p. 165) appears to give a quite correct route as follows: Tyana by Paraaon over a ridge 5450 feet, by Imrehor and Gurji Kale

* Since writing this paper I have consulted Ainsworth's 'In the Track,' etc., and find that his conclusion is the same as mine.

to Bashmakji (4¼ hours); past considerable ruins, the ancient roadway being plainly visible, reach Takhta Kupru (5 hours); and on to Gulek Bogaz station (15 hours) this being 1½ mile east of modern Tarsus. Total, 24¼ hours plus 1½ mile, or 74¼ miles at 3 miles to the hour. The ancient road was more direct by Bairamli; old Tarsus extended further north, probably, and Cyrus' camp may have been towards the south of Tyana plain. To me it is easier to reconcile this as being the total distance marched by Cyrus from his last halt than to trace a route of over 60 miles for his army from no matter what point at which he entered the Cilician plain until he reached Tarsus.

Prof. Ramsay is perfectly correct in stating that the passage of the Cilician Gates has not been widened in modern times, as it was said to have been by Ibrahim Pasha so lately even as in the discussion on the paper published in the *Journal* of September, 1902. On both sides of the passage inscriptions in Greek character exist—to the west on the side of the high overhanging rocks themselves, to the east on a great mass of fallen rock standing in the stream-bed a few yards from the roadway. Perhaps here the stream was covered by a viaduct in those days to widen the road at the passage. No doubt the roadway had fallen into disrepair at many times, but it was comparatively excellent a couple of years ago, and carriages passed easily, thanks to the energy of His Highness Ferid Pasha, the present Grand Vizier, who, as Governor of Konia, controlled its repair to Ak Kupru, the frontier of the Adana vilayet, in passing through which the governor, Bahri Pasha, also a painstaking official, looked after its care.

On pp. 368 and 370 (*Journal*, October, 1903), Prof. Ramsay mentions the fact that the modern road to Tarsus does not follow the stream from the Gates all the way down. The reason for this is a very simple topographical one as this Eastern branch of the Cydnus river flows to it some 15 miles above Tarsus in intricate hilly country, and no road for wheels would choose such a direction. The road seen south of Mezar Oluk ascending the opposite hillside does not lead directly down to Tarsus but goes across the hills to Namrun.

The traces of the ancient way are clearly seen to-day in the pass above Sarishekh. That place derives its name very evidently from Sarekle Sheikh, the "green-turbaned" Sheikh—in other words the Holy Sheikh as green is the Moslem religious colour. It has nothing to do with "Sare Eshek," the "yellow donkey," and Langlois was right. The connection is clear between this name and the "türbeh" or "ziaret," or holy shrine, mentioned on p. 371 (*Journal*, October, 1903), located here. That this point marks also the junction of important roads is self-evident from its topographical position. The valley down by Mezar Oluk, in which the modern road passes, is narrow and steep compared to the more open passage south-east, which holds the modern post road from Adana and in which I have met the mail travelling. The road is paved in parts, probably from Ibrahim Pasha's time; it was evidently at all times the main way to the Gates from the Cilician plain. The ancient road to Tarsus probably passed down here over comparatively gentle slopes, and also the Adana road which bore off eastwards when the Tarsus route turned south, as it did very soon, to pass down the easy valley leading towards the ruins lying to the west of Bairamli. These ruins, only recently visited by me, are on a high plateau stretching between the Cydnus river west and Bairamli, and covering an enormous extent of ground. They represent either the ancient summer residences of Tarsus or the great military camp for its defence towards the Gates. I traced the old paved way through it by the

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triumphal arch still standing and down towards the plain south where it is lost in the soft soil; but it could have passed anywhere to Tarsus where that city then lay as no obstacle intervenes. Standing south of the slopes below Sarishekh and looking north as one travels, the way just mentioned is the natural one evidently for the road. It is direct and easy, the present road bending considerably round to the west to gain the valley; an ancient way passed here also, perhaps, but hardly the chief one.

Around the Gates and to the north the mountains are of exceptional interest. They are here cleft asunder by two great natural passages, the valley leading north towards Kaiserie and the passage from west to south-east of the Chakut river. Taking those to the west of the northern valley first, we have the square-topped, not very high block close to the Gates as far as the Shahin valley west, which drops abruptly on its northern flank to the 4000-feet-high Tekir plain, across which we see the Bulghar Dagh rising gradually to the north and north-west. This great mass is the real backbone of the Taurus range from this point westwards for a considerable distance. Here on the south and east it is not precipitous; it rises gradually in well-wooded and watered hills and valleys to an average height of over 7000 feet, from which the high rocky peaks or sugar-loaf summits continue up to above 11,000 feet. On the north side, which extends along the line of the Chakut river and to Eregli, this mass is precipitous almost throughout to its base. As we follow the valley north from Tekir the Bulghar Dagh prominent points seen are the Ruzgiar Tepe, Kochan Dagh, and Giaur Dagh, all about 7500 feet. Just north of the Ak Küprü (bridge), aross the Chakut, rises the Karancha Dagh, a prominent conical mountain about 7000 feet. After this, on the west side of the valley leading north towards Kaiserie, there are no remarkable peaks, the range, which is here volcanic, becoming bare, treeless, and uninteresting in appearance, falling gradually towards Nigde and the plains round Develi Kara Hissar. At the gates to the east we have the Hajin Dagh, steep and craggy, about 6000 feet, extending north as far as the Chakut at Anasha, and forming the western boundary of this stream as it descends towards the Adana plain. To the north across this river rises the beautiful Ak Dagh, some 8000 feet, followed by the Karanfil, 9500 feet, all parallel to the valley, which leads slightly east of north to Kaiserie, narrow at the bottom and only 2 miles across from peak to peak, forming one of the most picturesque routes in the whole Taurus range.

It is very important to note how the main chain has here turned northwards for 20 miles from Bozanti Khan to the Ala Dagh beyond Jevizli Khan and the Karanfil Dagh. It is the Ala Dagh, or Red mountain, a most beautiful and striking group, rising up and extending from the valley we have been following, which leads the Taurus back into the original course eastwards. My notes tell me how I turned from the Jevizle Khan, height 4200 feet, up a steep rise on a general bearing of 60° to a col 8000 feet which separates the Ala from the Karanfil mountain. There are juniper trees about here. The track now undulates along the southern slopes of the Ala at a general height of from 7500 to 8000 feet. This is the summer home of many semi-nomads, or Yuruks whose winter villages are below and who pass a delightfully healthy and bracing summer in tents up here. I note that we are on a general bearing of 70°; in many places there is snow below us in the deeper ravines (June 29, 1903). On p. 390 of *Journal*, October, 1903, in a note, there is a question as to snow lying all the summer on the Ala Dagh. I should say that it would do so in the deep clefts on the northern side, but certainly not over any part of the exposed, open summits. These tower above us, grey and bold, as we pass along a route parallel to them; while the valleys beneath us stretch away to the south full of the most lovely and varied wild flowers, rare bulbs, new species of orchids until lately unknown to us at home but now to be found in Kew Gardens. Pine and cedar-covered hills, with clear trout-streams gurgling down between, slope to the great Adana plain; everything appears to combine to make this one of the wildest and at the same time in summer one of the most beautiful parts of the Taurus, stretching away eastwards to the Seihun river and beyond. Forest begins at 7500 feet; at 6500 feet, grows densely, while juniper is found still higher. This part of the world is unknown to all but the nomad and to two or three Europeans. The traveller Tchagachef crossed it from south-west to north-east once many years ago. I have been over and through it several times and so has Prof. Siehe, a very learned botanist with whom I have had some pleasant journeys and who is well known at Kew.

I note that one col crossed was 8200 feet. The highest Ala peaks—the Demir Kazek and Chakur Dagh—are 10,500 feet and 10,000 feet, or perhaps more. They lie over the Ajiman Yaila, 6500 feet, where ancient ruins and Greek inscriptions denote the wealth of the copper or iron mines around. From the Adana plain or the sea the Ala Dagh stands out a remarkable feature, especially when white with snow in winter.

One of the greatest difficulties experienced in my passage was from the kind and too constant hospitality of the occupants of the numerous groups of tents through which the road lay. At each the invitation to "bouyouroun" or to rest and to partake of coffee was renewed. They were overjoyed to find a stranger who could give them news in their own tongue, apart from their innate desire to be hospitable. To refuse their kindness would be rude, yet to accept meant an interrupted and slow march. Here, as indeed everywhere, the people are most friendly to any one who understands their ways and meets them halfway.

At the tents where I stopped one night I note that the headman, or "agha," was Mahmud Agha, from a village on the Chakut stream just above Adana town; another was from Chejeli on the plain, a third from below Karsanti; all from permanent villages. This brings us to a point of some importance in which so many are interested, namely, the nomad question. In my opinion there are no real nomads left in the western and northern parts except the few Turkmans who wander about almost as beggars from village to village. The nomad has become a settled villager who wanders only in summer when the vermin of his home drive him and the green pastures and cool waters of the mountain invite him to take to his tent and climb. I have seen no real nomads in these parts during nine years of travel, if by that word we mean perpetual tent-dwellers. All the villages of the

Cilician plains furnish the summer Yuruk and semi-nomad of the Taurus pastures and valleys. I think the real nomad now dwells only in warm parts such as Mesopotamia. Up north, having felt the comfort of stone or mud walls in winter, and of a roof, tent life at that season has become a joy of the past. Pages might be written on this subject did time permit; let me just add that in all my travels in the Taurus I met "friends" whom I knew in their villages in the plains. The Taurus is a perfect desert from October to March and in the plains all now dwell under roofs.

To return again for one moment to the Ala range, it is impossible to give here all the details noted but before leaving it the fact that it bears generally 70° to 75° must be emphasized—that is, slightly north of east. This continues almost to the Zamanti branch of the Seihun river towards Farash, where the eastern flank of the group rounds off. On all the maps I have seen the Ala Dagh is quite wrongly shown as being parallel to the almost north and south valley leading towards Kaiserie, doubtless because these parts were not explored. I have even seen the Ala Dagh included in the Anti-Taurus which is quite wrong. An erroneous impression of the whole range is thus given as it must appear to break off here, the country to the east of the Hajin, Ak, and Karanfil peaks being comparatively only low hills, and the Taurus minus the Ala group would be invertebrate indeed.

The Anti-Taurus commences beyond, that is east of, the Zamanti river, running north by Shahr and Azizie, including the Binbogha Dagh, the "Thousand bulls" mountain to the west, very often misspelt as "Bimboa," doubtless through ignorance of its derivation. Similarly, between Adana and the Ala Dagh the Pos Dagh, meaning bare or bald mountain, is misspelt Post. Hundreds of such cases might be given. The main Taurus is lower east of the Ala Dagh, as it crosses by Zeitun and south of Albistan, but it is a well-marked chain, nevertheless, in which all around I know of points which rise steep and craggy to 7000 and 8000 feet and more.

We left the Bulghar Dagh rising high to the north-west of the Cilician Gates and bearing off south-west. This great mass is a curious mixture of rocky peaks, rounded heights, deep precipitous valleys and easy passes. The highest points are towards its eastern extremity and the centre, to the south and south-east of Bulghar Maden ancient silver-mines. Here the most prominent are the Baimak and Choban Huyuk peaks, both 11,200 feet high, with the Kizil Tepe a little more to the east and not quite so high. This is a magnificent group which can be ascended from the Cilician Gates neighbourhood. Proceeding up the Karle Bogaz, or "Snowy Gorge," I reached the top of this valley by a fairly easy horse-track in four hours and a half, height 6300 feet, with tents of the Gulek villagers now up here (August 4, 1902). Riding on up a zigzag path along the now steep Bulghar Dagh slopes the Keche

Bel or pass is reached at 8300 feet which leads the track westwards to Bulghar Maden. We turn north here up a less steep path, passing the Geul Kar Geulen Tepe close to our right, 8800 feet, and reach the foot of the highest point in the Bulghar Dagh at 9400 feet. Here we leave the horses, and ascend on foot the round dome-shaped Choban Huyuk, which rises more and more steeply until the summit is reached. This is the highest point, 11,200 feet, from which a magnificent view is discovered all round—to Nigde and the Argæus mountain to the north, and to the sea south. The ascent is fairly easy from the south but craggy peaks tower nearly to the same height around, and on the

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north all is steep and precipitous. Snow lies deep everywhere on the northern side in the crevasses. This ascent is interesting especially as fixing the height of this part of the Taurus range, until now always under-estimated and sometimes as low as 6000 feet. It is really the highest part from the Mediterranean to Lake Van if we except Erjias Dagh or Argæus mountain, which is entirely separate from and to the north of the main chain.

Towards the west these mountains continue as a great mass at an average height of 10,000 feet, with low peaks rising here and there to 10,500 feet; and it is not until nearing the south of Egreli that any marked diminution of elevation is noticeable. The range then assumes the shape of enormous undulating downs or uplands upon which shepherds wander in summer and the moufflon finds young grass, while the ibex, or wild goat, prefers the rocky precipices in the valleys below. The Dumbelik Dagh follows to the west at a height of 8000 feet, gradually lowering westwards, until south of Karaman the average is 6000 feet, with a few points rising to 7000 feet. This closes in the Cilician plains to the west at the sea by Selefke. The general geological formation is Tertiary limestone in the outlying hills to 7000 feet, here and there some sandstone, then the higher mountains are Silurian metamorphic limestone. Favosite coral, columnar, metamorphosed into marble, and many fossils, are found at about 7000 feet, above Namrun.

The only wheel-tracks across the Taurus and Amanus range passes or roads to-day are Selefke to Karaman, the Cilician Gates, the Beilan road from Alexandretta to Aleppo, and the Sivas-Diarbekr road. The first is not in very good repair, but the three last are in quite fair order. Another cart-road is being made from Sis, *viâ* Hajin, to Sivas, and a sixth wheel-track from Malatia to Marash and Aleppo. Horse-tracks cross in every direction and at many points, so that any special mention of the dozen at least which I have followed from Malatia, Albistan, Sivas, Geuksun, Kaiserie, Eregli, Konia, Karaman, or Haleb (Aleppo), to the Cilician plains, would fill more space than we can now spare. The Taurus south of Malatia presents another beautiful, interesting and but little-known group. I crossed it in October, 1902, following from Marash a very fine ancient road, said to be a Turkish one from the capital to Bagdad, but probably remade over the Roman road from Geuksun and the Anti-Taurus. At Belveren it branches off south-east to Samsat, the ancient Samosata, to be joined by another ancient road, which passed south, to the east of Adiaman, from Malatia. I left the old road at Belveren, north of which an easy valley leads up to Malatia where the new wheel-road is passing as it comes south to Aleppo, and I followed east by Besne to Adiaman, the track being easy all this way. Here I struck directly north, following generally the line of the telegraph-poles to Malatia by a road marked on no map and probably never before passed by a European. It is a wild and lovely country, inhabited by Sunni, or, according to Turkish Mohammedan ideas, orthodox Kurds, a scant population, living in villages in valleys in winter, becoming tent nomads in summer; to me most friendly and hospitable, although sometimes attacking Government officials. The total distance across is 68 miles by a track bearing slightly west of north, rising up the Taurus at $2\frac{1}{2}$ miles from Adiaman, a well-situated town of seven or eight thousand souls, 2600 feet above the sea. Then follows a rise, then a valley, after which we climb for some 10 miles to the Yailajik pass, 5600 feet, and again descend, bearing forward here 330°. So we proceed, up and down, by lovely valleys and magnificent mountain passes, the highest crossed being the Merkezer, 6250 feet, and the Su Batan Bel, 6450 feet. After this last passage we begin more gradually to descend. The geological formation is generally Tertiary limestone, with much conglomerate. One peculiarity is of interest. To the west, over Cilicia, the Taurus is more steep and rocky on the northern side, whereas here we have easier and more rounded slopes as we advance towards Malatia, north. The highest peaks around this route were the Külbe Dagh, estimated at at least 8000 feet, and the Su Batan Dagh, 7500 feet. The route is a mountain track which about half-way bends round again slightly east of north. Two interesting streams are passed near the Su Batan pass, one which disappears down a cleft to issue out again far down a

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valley, and the Malatia stream, gushing out of the rocky base of a mountain by the road-side and flowing down a nice river from its source, which gives the town below the gardens and fruit for which it is famous, before it enters the Sultan Su and the Euphrates to the north and east, a few miles away. Another track between these towns passes slightly east while the ancient road crosses farther away by Kiakhta.

To two other passages only across Taurus shall I allude: the first in connection with the Hittites and their art, upon which we, who have seen their traces with our own eyes, are especially anxious to throw light where possible. We know that their rock-sculpture and hieroglyphic writing extended as far as Pteria to the north and to Beyshehr beyond Konia to the west. Prof. Ramsay's references to this people, on p. 35 of his 'Historical Geography,' are most interesting. He states that Syrian Hittite art shows greater development and a later date than it did in Asia Minor. Could it have been that this people had extended north at an earlier period and were driven back south before a new and stronger rising power? Or did they just come up to this high ground in summer to avoid the Syrian sun as the Yuruk climbs the mountain Yailas with his flocks still to-day? On the same page we read that an important road probably existed connecting Pteria with Assyria by the Anti-Taurus region and a pass between Albistan and Marash. This is more than probable. Its natural direction would be up the flat valley between the Kurt Dagh and Amanus range, so easy that carts pass over all parts to-day south of Marash. Beyond that to the north there is quite a choice of routes; I having crossed the Taurus here myself by four different tracks. Of these the one I am most inclined to select for the ancient way crosses the Jihan river west of Marash and follows a generally easy line by Tekir Khan and over the Ayer Bel to Geuksun, distance 54 miles. The only obstacle is the Ayer Bel, or pass, 6600 feet high, but the ancient road turned this certainly by making a *détour* round east where there is a very easy and low passage by the valley between the mountains. At Geuksun we meet the ancient Roman road to Albistan from the Anti-Taurus in which range several easy passes exist for the Pteria road to have traversed. In the valley south of Marash, already referred to, we see at Zinjerli, close to the Baghche pass across the Amanus range, some Hittite remains lately excavated where two large stone lions and many other objects were found. They are not extensive, so far as it is at present ascertained, covering a small knoll in the plain. They may have represented some monument, gateway, or military post on the ancient road. Bearing on Prof. Ramsay's theory it is important to note that west of the Amanus and south of the Taurus, that is, in Cilicia, I know of no remains which can be said with certainty to be Hittite. Their road lay as indicated; they probably did not cross the Amanus westwards to encounter what would have been at all times enemies from across the seas or pirates settled on the Cilician side.

The last passage across the Taurus to be alluded to is that by which Cyrus despatched Menon and his light troops which turned the Cilician Gates in their descent upon Tarsus. Ainsworth, in his commentary, gives the route as passing Kizil Chasmah, Alan Buzuk, Mazatli, Soli, or Pompeiopolis, and onward to Tarsus. I do not know from what source this information is taken, nor do I recognize the first two places named although all these parts have been examined by me, but I am under the impression that Mazatli, Soli, and Pompeiopolis are one and the same. Most probably the bend south towards Karaman, the ancient Laranda, was made to avoid the direct passage from Konia to Tyana across the comparatively desert plain, the Axylon. We read, I think in Strabo, of the fertility of those parts around Laranda, and of the beauty of the forests. Cleopatra is said to have been given a forest of magnificent cedars not far south of this from which the masts for her Egyptian fleet were obtained. It is sad to relate that the Karaman plain to-day stands treeless, the rain and water supply thereby reduced; and passing through Cleopatra's cedar forest a couple of years ago I found its remnants lying in ashes around, a fire having just occurred. If Menon branched off here south-east he would have had a choice of two direct and easy routes to Tarsus; the more northern from Karaman to Ibraila, Korash, and across the broad, flat Dumbelik plateau, down the easy pass of that name by Chatal Cheshme (where the ancient road remains to-day in fair preservation), and on by easy gradient to the plain north-west of Tarsus. This is a remarkably easy way; no doubt in ancient times chariots could pass. Further south an equally easy road passed by Maghra and Efrenk, joining the one just mentioned south of the Dumbelik pass, and which traversed a more fertile district. There are ancient ruins and inscriptions on both ways. The Pompeiopolis road would lead down to the coast south, causing a great *détour* and being steeper. It is difficult to trace a reason for such a diversion.

The passage of some of those ancient roads to-day, especially of those in wonderful repair leading from the coast around Corycus and the ancient island of Elæusa towards Olba, suggests at once the thought of how horses' hoofs were treated in those days for passage over such great blocks of smooth stone. It would appear that they were not shod. In endeavouring to solve the interesting question as to when horseshoes were first used, I made inquiries at the Quirinal Museum in Rome last autumn, and found that this was apparently in Marcus Aurelius' reign (161 A.D.), and the proof lies in his own equestrian statue in that museum, where his horse's uplifted foot shows the shoe with six nails, whereas previous sculpture only gives the uncovered hoof. This is hardly an unnecessary digression as the subject must interest all of us deeply who have wondered as we looked upon such roads. I have to thank the British Museum also for information on this matter.

The last completed section of the Bagdad railway extension is now open to traffic to a point a little east of Eregli. Crossing the intervening hills east the next section will reach the Chakut river and follow its direction down generally by Bozanti and beyond to a point south of the "Earth bridge," already described, when it will pass by tunnel to the south side of the Taurus. Here will be a loop or bend west, and again back east, in order to bring the line to the plain level by a gentle incline along the contours of these hills. I use the future tense advisedly, being of opinion that this will be an accomplished fact in a not very remote period. No insuperable engineering difficulty presents itself. The Chakut course is selected, and the line will not pass near the Cilician Gates, in order to avoid the rise from Bozanti at 2600 feet to the Tekir Col at 4250 feet, with a subsequent proportionately increased descent to Adana. The points to be considered in connection with this enterprise are political, commercial, and strategic. It is said that Turkey is very desirous that it should be carried through, and Germany appears to be so equally. These are powerful factors towards its success. The total cost is estimated at from twenty to twenty-five millions, a large amount but one which need not necessarily be found in one sum. If we do not join in the enterprise the line will be probably constructed by degrees in comparatively easily-financed sections. It is hardly necessary to dwell here upon the self-apparent political as well as commercial interest to be derived, from such a railway traversing all this country, by a foreign power engaged in its construction and management.

The argument that it cannot pay is often brought forward as a reason for holding aloof from the scheme. This argument is really one in which Turkey alone is financially interested as she would, by the kilometric guarantee system, be obliged to secure the payment of a fixed rate of interest from other funds to the bondholders. It is also sometimes said that the railway cannot be a commercial enterprise and that no other line in the country pays. If we look at this matter from a Turkish commercial standpoint we see that the Anatolian railway pays enormously. All around it to Angora as well as to Konia prices of cereals have increased considerably in value as well as in the quantity produced, a measure of wheat having jumped from 20 or 25 to 60 and 70 piastres. Nor should we lose sight of a strong humanitarian argument in the greatly increased prosperity, wealth, and happiness of the population. The camel and pack-horse traffic plying before to the coast now feeds the railway from the interior. The Angora kilometric guarantee fund, being no longer required there, has been transferred to the Konia-Eregli section.

The Eregli-Adana section will hardly come under paying conditions at first as the Adana-Mersina railway carries to the coast, but as soon as the main line passes to the east, beyond, and down through Mesopotamia, the advantage to Turkey will be enormous as well as to universal trade. All those parts, now necessarily a nomad-traversed grazing country because no means of profitable transport exist, will, with the advent of the railway, and of irrigation later, become one of the finest cotton and grain producing parts of the world. It must not be said, therefore, that this line cannot pay or prove to be of commercial advantage. Nor should it in any way clash with our own already-established trade interests, our great lines transferring some of their ships to the gulf, our river steamers from Bagdad to the sea reaping the advantages of increased production, commerce, and local wealth, and competing easily with the railway in freights. We need not enter here into the strategic advantages to Turkey to be derived from this line. The questions to ask are, can this railway be made without our participation; and if we participate, can we obtain the conditions and guarantees of every description which we may feel bound to demand? I have no doubt that, when the proper moment comes, the affirmative to the second will render the first question superfluous, and if this civilizing and beneficial undertaking, the railway to the Persian gulf, be ever an accomplished fact it will be so with the full measure of Great Britain's participation and goodwill.

Before the paper, the PRESIDENT said: I now introduce to you Colonel Massy, who, after having served his country as an officer, has been for the last nine years in the consular service, seven of which have been passed in Asiatic Turkey, about which he is going to speak to us. But those seven years were not spent in a consular office. They were employed in going about the country doing very valuable consular work, and at the same time very valuable geographical work. Colonel Massy, having been a long resident and traveller in those districts, has had very marked advantages over the ordinary traveller or explorer who passes through a region. In the first place, he was familiar with the language of the country; I understand that he talks Turkish like a native, and he also has some acquaintance with native dialects and other tongues on the borders. But even more than that, Colonel Massy, from living there and travelling there, has long ago become acquainted with the idiosyncrasies of the various tribes and peoples who inhabit those regions, so that he is and has been in an exceptional position for acquiring information both rapidly and accurately. Any one knows, of course, who goes for the first time to a new country—it is astonishing how little Asia Minor has been travelled over—the difficulties met with from want of knowledge of the language or from friction with the people. Colonel Massy has had none of those difficulties. We welcome him as a representative of that great consular service which in various parts of the world has done such admirable geographical work. I call upon him to read his paper.

After the paper, the PRESIDENT said: I noticed that Colonel Massy referred in the course of his paper to Sir Charles Wilson, who I think is one of the oldest Fellows of this Society who has travelled in Asia Minor and written on it. I am afraid he is not here to-night. As we cannot get the oldest of our travellers we will get one of the youngest, and I venture to call on the Earl of Ronaldshay.

The EARL OF RONALDSHAY: I should like, if I might venture to do so, to congratulate Colonel Massy on the very interesting and important paper he has read to us this evening. I think it is a paper which has been listened to with interest and attention by everybody here present, and it is certainly a paper of especial interest to myself in that it has gone a very long way in filling up the many blanks necessarily left in a picture formed from a merely cursory personal inspection of some parts of the country which he has so admirably described. I should like to say I fully support what Colonel Massy has said with regard to the maps of the country. I only hope that the vast knowledge and experience he must have acquired in the seven years he spent in that country will be devoted in the future to correcting, improving, and bringing up to date the maps that are already in existence. I think you will agree with me that it is to men like Colonel Massy, who are in a position to make a long residence and carry out extensive journeys in such countries, that we must turn to get accurate geographical information. I know only too well the difficulties which confront the casual traveller in determining, for instance, geographical names from mere verbal information which he may receive in the country. The casual traveller, unlike men who reside in the country, is probably not very well acquainted with the language of the people among whom he is moving. I think Colonel Massy will probably tell you that geographical names are for the most part based upon everyday objects. In some parts of Asia that is a system which is given an even further extension. I have come across instances among the Kirgiz in Central Asia where they carry the custom so far that the object which is first seen by the mother after she has given birth to a child is very frequently responsible for the name of the child. That is a custom which we can understand is apt to be of very considerable inconvenience to the aforesaid children. I remember myself, when travelling in Central Asia, coming across a Kirgiz man whose mother had the misfortune to see three old ladies at the door of her tent shortly after she had given birth to her son, and "three old women," or what is the equivalent to "three old women" in the Kirgiz vernacular, was the name that man was destined to carry to his grave. That is only one of the many difficulties which surround the casual traveller, which, I think you will agree with me, melt and disappear before the knowledge and experience of men like Colonel Massy, who have had the opportunity of long residence in the country. Now, sir, I am bound to admit that it is Eastern politics and Eastern diplomacy and Eastern intrigue which have formed the magnet that has been chiefly instrumental in drawing me to visit the more uncivilized countries of Asia, and I am not going to say many words lest I should run the risk of being ruled out of order in travelling from the domains of geography into the realms of politics. There is one border, however, where they may be said to meet, and which can be described as common ground to both these sciences, and I would venture to say one word which should touch upon these zones. I think it has been said by Colonel Massy that travel and exploration act as an incentive to the historical study of the region traversed. I think he might have said with equal truth that travel over and exploration in those countries, which slowly but surely, willingly or unwillingly, are being forced into the vortex of world-movement, throw a very much-needed light upon the probable or possible direction of the advance of powerful and expanding neighbours. If I might give you an instance of what I mean, I might quote the case of eastern Persia. It is essential that those who are responsible for the defence of our Indian Empire should know whether the physical conformation of Khurasan will invite or admit of the building of railways from north to south along the western frontier of Afghanistan. Speaking personally from my own experience, I am inclined to agree with the conclusions of Sir Thomas Holdich that they will not do so, but whether that be so or not is perhaps beside the point in the discussion this evening. The point is that a satisfactory conclusion can only be arrived at from accurate knowledge of the physical geography of the country, and in that connection I think Colonel Massy has raised a very interesting point in the remarks he has let fall with regard to the future construction of railways across the Taurus mountains. Now, I have travelled on the Taurus mountains in mid-winter, and I might say incidentally, that my experience is in entire accordance with the conclusions Colonel Massy has come to with regard to nomad life in that country; that is to say, genuine nomads are practically non-existent, and the tent-dwellers retire during the severe winter to the more substantial abode of the permanent villages in the plains. Now as to the railway itself, we have been told on the authority of no less an expert than Prof. Ramsay, that for the first 30 or 40 miles from the time that railway passes into the range of the Taurus mountains no engineering difficulty whatsoever would be met with. The railway for the first 30 or 40 miles beyond its present terminus will only meet with a continual and easy descent through an easily traversed valley. But beyond this point, beyond a little place which I think Colonel Massy described as Bozanti, the railway, instead of following the usual route through the Cilician Gates, will be carried along the course of the Chakid Su, and it is as to the nature of that piece of country that I should like, if I could, to obtain some rather more detailed information, for it is here that the one great obstacle which the railway will be confronted with will be met. We have it once more on the authority of Prof. Ramsay that the glen at this point comes to an end before what he describes as a wall of nearly 2000 feet in height, with hardly any room for curves, and I was told by an engineer in charge of the railway construction at Konia that something like seventy tunnels would be required before it could be carried to the Cilician plain. Seeing that Colonel Massy has expressed an opinion that that railway will be built in the near future, I should very much like, if it were possible, to extract from him or from anybody else who may be present some rather more detailed information as to the difficulties with which the engineers will be confronted in the course of that section. I certainly hold the opinion that sooner or later the people of this country will be approached with a view to securing the co-operation of this country in the enterprise which is known as the Bagdad railway scheme, and I do hold that, when the time comes, the men who are called upon to deal with that situation should be in possession of as complete a knowledge as possible, from a political, a commercial, and a financial aspect, and from the one which interests us this evening, from a geographical point of view. Now, sir, it is in order that I might have the pleasure of congratulating Colonel Massy on the very interesting paper which he has been good enough to give us this evening, and also that I might, if possible, extract a little further detailed information either from him or from any one else who has travelled over the country that I have ventured to enter upon your discussion with these few brief remarks.

The PRESIDENT: I understand there is a lady present, Miss Jebb, who has travelled over the line; if she is here, I hope she will honour us with a few observations.

Miss JEBB: I have been asked by Colonel Massy to say a few words to-night because I happen to have travelled on the particular line which the Bagdad railway is supposed to be going to follow, but I must apologize for not having any qualifications to speak before the members of the Royal Geographical Society, and I have nothing at all profound to say. I would like to say that I am glad of this opportunity to make it known how Colonel Massy fulfilled one of the functions of a vice-consul in a way which I would like to see others follow—that is to say, he encourages travellers. If it had not been for Colonel Massy, I think it is quite certain that neither I nor my companion would have had the opportunity of travelling where we did.

One point Colonel Massy mentioned about his experience in the Taurus I would just like to comment on. I also have travelled in the Taurus mountains in winter, and I can endorse what has been said with regard to there being no nomadic tribes. I met with no nomadic tribes. But there is one remark of Colonel Massy's I cannot endorse—he says the roads through the Cilician Gates were excellent a few years ago, and good for carriages. I can only suppose he has lived so long in a country where the standard of roads is not good, that his standard is lower than mine. I also passed through the Cilician Gates, and it was in a pouring rain and very heavy mist, and I can certainly say that the road would be as easy to drive a carriage over as perhaps the chairs occupying this room. We travelled from Konia, the terminus of the Anatolian railway, to Olu-Kishlu, and from there, instead of going by the usual route on to Bozanti, we struck across the Taurus mountains and came over a pass just above Bulghar Maden. I happen to have an altitude there, and I mention it because it rather illustrates what Colonel Massy has said about the range of the Taurus being underestimated. Where we passed over the range it was 5800 feet, and we seemed hardly to have got any way to the top of the towering masses above us, so that I should certainly think that 6000 feet is a great deal too low to fix as the average height of the range. There is another thing, referring to the question of the Bagdad railway—we followed the course of the larger towns to the north, which I believe the railway will miss. It has often struck me what a great agricultural opening there would be if the line followed this course. Between Urfa and Birejik on the Euphrates, it struck me as an agriculturalist that the soil was tremendously fertile, and a great deal of it was under cultivation; there did not seem any engineering difficulty in going straight to Urfa with a branch to Aleppo. Colonel Massy has alluded to the difficulties of maps, and I am sure any traveller in that country will endorse that. We were very much inconvenienced very often by the fact that the local people never seemed to have heard of any village about 10 miles distant from themselves, and if they had heard of it, it generally had four or five different names from that marked on the map. We were told that it was particularly unsafe for two women to travel alone in Turkey. I can only say that I do not suppose I have ever been so well treated, or so well looked after, or so courteously received as during the seven months when my friend and I travelled alone in Asia Minor. We had opportunities which perhaps even Colonel Massy did not have, for we were able to go into the harems and see a good many of the women, and in that way I think we saw one side of Turkish life which certainly men travellers do not get to see at all. It is, of course, no use dilating on the difficulties of travel in that country, because if we did, I think people in this country would think we were drawing a long bow.

Sir CLEMENTS MARKHAM: I have very little right to join in this discussion and there is very little time to do it in. My personal knowledge of Asia Minor is entirely confined to one spot, though that is a very interesting spot, on the eastern coast; but Asia Minor has long been interesting to all geographers, because from the fifteenth century it has been, geographically speaking, until quite recently an almost unknown country. It has been one of our *Terræ Reclusæ* like the central part of Africa fifty years ago, and yet in Asia Minor the most interesting historical events have taken place. I think we must all at some time or other have been entranced by the thought of those ten thousand Greek explorers marching along the whole length of Asia Minor with such an accomplished geographer for their guide as Xenophon. But our geographical forefathers were quite unable to follow him, on account of their total geographical ignorance of Asia Minor. Major Rennell, the greatest of English geographers, attempted to do so, but he had nothing to help him but the inaccurate map of D'Anville; which, among other things, was one degree out in latitude, therefore many of his remarks are now valueless. But I would, in a few words, wish to remind the Fellows of this Society how much we have tried during our whole history to further the exploration of Asia Minor. In our very beginnings, when we were very poor, we contributed close upon two thousand pounds to aid Mr. Ainsworth's Kurdistan expedition. The labours of our former President, Mr. Hamilton, the more voluminous labours of our

Vice-President, Colonel Leek, were the forerunners of very splendid work which has been accomplished in more recent times, and this Society has done all it could to help and encourage exploration by subscribing to the Exploration Fund, by bringing out that valuable work of Prof. Ramsay's, 'The Historical Geography of Asia Minor,' and by lending our instruments to many travellers in the country. But still, until we received the results of these explorations we were in great ignorance of Asia Minor. But we must now feel what a good return we have had, consisting of the labours of such men as Ramsay and Wilson, and Myres and Hogarth; and another result has been the valuable map of Colonel Maunsel, and still another the excellent paper we have just listened to from Colonel Massy. I think we must all have been impressed by this fact, that there can be no intelligent knowledge of history without the help of geography, and for that reason I think that the work that has been done by this Society to encourage exploration in Asia Minor is work of which we may be proud, and I trust we shall be able to continue to do so on every possible opportunity.

The PRESIDENT: The hour is now so late that I am afraid we have no time to call upon other speakers. I will simply propose a hearty vote of thanks to Colonel Massy for his excellent paper.

Colonel MASSY: I should just like to answer Lord Ronaldshay. Everything is a matter of comparison, and when one travels over some of those almost tractless mountains, he will find his ideas of a road somewhat changed. These roads you could pass on wheels. As to the railway, I do not think there will be very many tunnels at all. I happened to stop in that country for over a week with the engineers when they were considering the routes by which it would be best to reach the Chakut river. Then it would reach the Taurus, and then it would pass through one single tunnel, and that would be a very long one; but having passed out of that, the railway would take a bend to the south, and then it would bend to the west, gradually going to the side of the cliff. The whole height is not great, and then there would be the tunnel; that would bring it to about 800 feet, and then, bending round the loop, it would reach the plain. I don't think I have anything further to say, except to thank you for the great patience you have shown in listening to my paper.

A JOURNEY AMONG THE HIGHLANDS OF CHILI.*

By E. C. YOUNG.

THE following lines describe the writer's experiences during an autumn journey in North China, in the province of Chili. The greater part of the province of Chili, it should be explained, is a vast alluvial plain which stretches northwards from the Gulf of Chili to the mountainous region which separates it from Shansi and Mongolia, and it was in this latter district that the journey was made in the autumn of 1904. The chief object of the expedition was to explore a little-known and unsurveyed district to the north of Cho Chau, a large provincial town on the Franco-Belgian railway between Pekin and Pao-ting Fu. A route survey was to be made for the benefit of the British Intelligence Branch of the North China command, and much kind assistance was

* Map, p. 368.

received from Colonel Wingate, the head of the department, who moreover despatched an Indian surveyor, Abbaz Khan by name, to assist in the survey. A secondary but also important part of the scheme of operations was to trace as much as possible of the course of a river called the Chu-ma Ho, which as yet had only been partially surveyed. My party consisted of seven members besides myself, viz. Abbaz Khan, my "boy" or body-servant, a Chinese Mohammedan to cook and "do" for the Indian, three survey coolies, and, last but not least, an English sheep-dog of mine called "Shep."

The first day's march from Cho Chau was over a level plain which stretched almost to the foot of the hills, and it was not until well on in the afternoon that the ground began to rise; the road now became rougher and rougher, and was sunk below the level of the ground, in some cases to a depth of 15 feet. Leaving the main road, we struck across country, and by dusk reached the tiny hamlet of San-tsaw-an, nestling in a valley formed by the spurs of a prominent mountain which was our objective.

The following morning broke fine, and, after an early breakfast, arrangements were made for the ascent of the mountain (Peak No. 23, as it was called), a "fixed point" on the maps of the Intelligence Department, from which, being 3500 feet high, it was hoped that a useful reconnaissance of the country before us might be made, whilst possibly a glimpse of the Wu-tai Shan—a mountain of some 9000 feet, situated in the direction of our route—might be obtained. Peak No. 23 was an innocent-looking mountain, resembling in shape the half of a sugar-loaf, and in the clear morning air it looked so close and easy of ascent that we gaily contemplated returning by lunch-time. No provisions were carried, therefore, and those of the party who were not selected for the ascent were ordered to remain in camp and stand by to pack the mules and strike tents as soon as they saw us returning. The path was a mere goat-track, which, leading over a low pass, dipped down into the valley which lay immediately at the foot of the peak. Here we engaged a guide from some peasants working in the fields, and after about a mile began to ascend, and were soon zigzagging our way up the side of a rugged and precipitous slope, where, at a short distance, the path was quite invisible, and where a stumble would have sent one ricochetting into the valley beneath with long odds in favour of a broken neck. Higher and higher we climbed, till one's legs almost refused to surmount the rocky steps and boulders over which the track continued. After about an hour of this, we reached the crest of one of the spurs of the mountain, where the track ran at a reasonable gradient for some distance. Pursuing our course, we found that the eastern slopes of the mountain were considerably less steep than those on the west where we had ascended, and we were agreeably surprised to find that cultivation was continued about two-thirds of the way up to the top of the peak, suggesting that there must be water at hand somewhere. Presently, to our delight, we came on some pear trees heavy with beautiful yellow fruit; and in the twinkling of an eye the coolies were in the branches shaking down scores of luscious fruit, which we fell on literally tooth and nail. They were delicious, and in our somewhat ravenous condition their flavour was as nectar. A little further on we came to a few houses nestling right under the peak, where a rivulet of clear cold water was trickling down the mountain-side. We now thought ourselves within easy reach of the summit, but another hour's hard climbing up the steep sides of the cone was required before we at length reached the top, by which time it was almost noon. The day was fine, and, though not as clear as might have been wished, there were magnificent views displayed on all sides. No. 23 was a real peak, and, the summit being only a few feet in circumference, the landscape was laid out before us on all sides like a map. To southward the wide plain of Chili stretched to the horizon like some dull green sea, the numerous villages and towns showing as mere patches of brown on its surface, whilst the course of the Chu-ma Ho could be distinctly traced from Cho Chau to the point where it emerged from the hills. It was to northward, however, that our eyes were turned; and here the resemblance to the sea was also maintained, though in this case it was a stormy sea whose waves were rugged, jagged mountain-tops which continued in endless ranges as far as the eye could reach. Nothing in the nature of open ground could be discerned, but peak beyond peak and range beyond range in unbroken succession, whilst no signs of inhabitants or cultivation were visible. The hills were barren and rocky for the most part, but on some a scanty covering of grass or stunted scrub coloured them a dull green, which, further and further towards the horizon, the haze of distance changed gradually into purple and light blue. Amid such a countless multitude of lofty hills, it was impossible to select any one as being the Waw-tai-shan, and we had to content ourselves with making a rough sketch of the general features of the surrounding country and taking sights with the theodolite to a few of the most prominent peaks which seemed to lie in the direction of our route. This done, it was high time to descend, for we were all shivering in the chilly blast, and, moreover, it was now 2 p.m., and we had no wish to make any part of the descent in the dark. The descent was a slow and rather wearisome job, as we were stiff and tired, and it took nearly as long to come down as it had to go up, so that it was after five when we eventually reached the camp. The net result of our labour was rather disappointing, as, although we had had a fine view, yet no particular advantage had been gained, whilst we were all more or less footsore and tired out by the stiffness of the climb.

Next day our march lay across the low grass-covered foothills which separated the real mountains from the plains, and by evening we reached the small town of Chang-fang, which, though shown on our maps as being some 10 miles to the west of the Chu-ma Ho, was found by us to be actually about a mile to the east of that river. We found an inn there, the last we were destined to meet with till the completion of our journey.

Chang-fang marked the limit of explored country in this direction, and it was with a pleasing feeling of expectancy that we set out next day. A few miles north of Chang-fang the river Chu-ma Ho emerges from the mountains, and a short walk brought us to the water's edge. The river at this point was some 100 yards wide and from 3 to 5 feet deep, without bridge or other means of crossing. After much delay and useless jabbering, a guide was secured who piloted us over a ford some 400 yards down-stream.

Although the frequent fords made us look on the Chu-ma Ho with some aversion, the river was a beautiful sight, dashing and rippling over its rocky bed, its water as clear as crystal, its banks hedged with perpendicular cliffs and lofty hills which were clothed in short green brushwood which autumn was already streaking with purple and gold. Animal-life was conspicuously absent, and the lonely character of the gorges was but accentuated by the dull roar of the river as it forced its way over its rocky bed hushing all other sounds, and making it surprisingly difficult to call to one another at any distance. Our road was a mere track, which, sometimes hugging the foot of the hills and sometimes losing itself in the boulder-strewn shingle of the river-bed, was always rough and impracticable for any kind of transport except the sure-footed mules and donkeys which were always to be found at every village. Occasionally we saw flocks of goats browsing on the steep mountain-sides, and the ubiquitous Chinese pig—black, hairy, and dirty, as usual—was always to be seen in the villages, as were also a few cows and oxen used for ploughing the patches of land which the thrifty peasantry contrived to cultivate wherever the soil was sufficiently free from rock. Apart from the villages, however, there was a singular absence of living creatures, either feathered or furred, and although the brushwood must assuredly have held game, we saw no sign of it, though the natives told us that deer and even wolves were to be found in the hills. The roughness of the track, and the frequent delays caused by the numerous fords, made slow progress the rule, and we only averaged some 10 miles a day on this part of the route. The first night out from Chang-fang we camped at a hamlet called Liu-tu-ling, a picturesquely situated cluster of houses surrounded by orchards of Persimmon trees, whose large yellow fruit looked like luscious oranges.

The following day we continued to hug the river, with its usual succession of fords, until reaching the village of Hsi-munn-ling, where we were told we must take a roundabout route through the hills, as the river was too deep to be forded. The road now entered a sombre ravine between steep and lofty hills, which, shutting out the rays of the afternoon sun, made it as dark as though it were actually dusk. Of habitations there were none, and the intense stillness and dank vegetable smell reminded me strongly of the dense jungles of Assam where the sunshine never penetrates. An hour's march brought us to the foot of a rocky slope, which, rising at an abrupt angle to a height of some 1800 feet, was dignified with the name of a pass. Surveying over ground of this type is not easy, and our progress was very slow, whilst halfway up the pass we took a wrong turn, which landed us in a *cul-de-sac* at the foot of a precipice, from which we had to retrace

GORGES ON THE CHU-MA HO, WITH NATIVE BRIDGE.

our steps; so that it was not till 5 p.m. that I reached the summit, where, according to the kindly Chinese custom, there was a little temple built for the use of travellers. Doubtless the idea is a pagan one—the Buddhist shrine testifies to this—but in practice the temples, which are nearly always found at the top of all important passes, must often be of real benefit to wayfarers, especially in winter, when the shelter thus afforded would enable the traveller to light a fire and make some defence against the bitter cold of North China. I have no doubt that many a poor Chinaman has offered up a genuine prayer of thanksgiving on reaching one of these mountain shrines.

The following day was cold and windy, and our route again followed the course of the river with its usual succession of fords. We crossed two bridges, ingenious structures composed of rough logs laid across piers built of basketwork cribs filled with stones, the roadway being made of stout wattled willow mat. The fords were particularly deep and numerous on this part of the river, and we were wetted and chilled continually in the cold wind, so that we ought to have "caught our deaths of cold;" but none of the party suffered in any degree from the constant wettings they experienced. Our troubles with the fords were nearly at an end, however, for by four o'clock we reached the junction of the Chu-ma Ho with its most important tributary, up whose bank we were told our road lay. The main river here makes a bold curve to the south-west, and disappears between frowning hillsides as though plunging into the "bowels of the earth," the sudden hushing of its ceaseless murmur resembling the stillness following on the disappearance of a train into a railway tunnel. The tributary was a mere mountain stream, at this season merely a foot or two in depth, meandering through a stony valley about half a mile wide, which, judging from the water-worn shingle with which it was strewn, serves as a channel for the overflow of the stream after rain. By dusk we had reached Se-shih-ko, a rather larger village than those we had hitherto met with, where they boasted that they once *had* had an inn, but that for want of custom it was now occupied by the residents of the place.

At Se-shih-ko we made a very late start, as our mules and their drivers had gone away somewhere, and did not turn up till nearly ten o'clock. Meanwhile, the result of repeated inquiries showed that the tributary stream whose course we were pursuing would take us too far to the north-east, thus diverting us from the unexplored regions we wished to traverse. I therefore decided to leave the stream and take a hill road to the south-west, hoping in this way to strike some feasible route leading in the desired direction. Accordingly we commenced climbing the hills soon after leaving Se-shih-ko, and, after a long gradual ascent, reached the top of the Tan-tze-ling pass by about 4 p.m. Here again it was our luck to get separated from the baggage party, and by the time we reached the foot of the pass darkness was upon us, and the survey had to be stopped. I decided to halt here for a day. It was, unfortunately, foggy and damp the next day, so that no astronomical observations were possible, and photography was also of dubious value, and the greater part of the day was therefore devoted to "plotting" our work and overhauling our gear. A reconnoitre of the position showed that we had again joined the main stream of the Chu-ma Ho, whilst inquiries led me to believe that I had at last hit on the direct route into the unexplored track beyond the Great Wall for which I had been searching. Having already surveyed so large a portion of the Chu-ma Ho, I was loth to leave it altogether, whilst it was by this time quite evident that the time at my disposal would not admit of as long an excursion beyond the Great Wall as I had originally intended; I therefore determined to divide my forces, and despatch Abbaz Khan to make a leisurely survey along the main river, whilst I, with the picked men of the party, made a rapid journey to the Great Wall, and as far as possible outside it, returning by the best route I could find to rejoin the Indian at Pan-chüng, a place apparently of some importance, to which it seemed I should be certain to find a road. The next day, therefore, I divided the party, and sending the "policeman" and two other men with Abbaz Khan, and taking only the "boy," the "volunteer," and the best of the survey coolies with me, I started *en route* for the Great Wall.

It was a dripping foggy morning as we left Peng-taw, and I was struck with the strong resemblance that the country hereabouts bore to the uplands which border on Dartmoor. The frowning cliffs and towering mountains which hitherto had hedged our route had now given place to rolling hills of more modest height, whilst the grass-covered valley, with its low stone walls and browsing sheep, looked very homelike viewed through the morning mist. Our road, as usual, followed the course of a mountain stream, a minor tributary of the main river; but the going was better than we had experienced since entering the mountains, and we made fair progress. We ascended gradually throughout the day, and this had the effect of dwarfing the hills to some extent, whilst the country was undoubtedly more open than that we had hitherto been travelling in. Late in the afternoon we sighted a stone tower in the distance, which we decided must be on the Great Wall, and before long we saw the wall itself climbing the hills to right and left of our route. A short pull and a strong pull brought us to the top of the pass and to a gate in the Great Wall, where the aneroids showed us to be 3000 feet above the sea—the highest point we had yet reached, with the exception of Peak No. 23.

It would be easy to write a glowing description of the Great Wall of China, and, indeed, one could find plenty such already printed in the various books describing this world-famed structure, but truth compels me to state that, though striking and interesting in its way, it did not inspire that open-mouthed admiration that one might have expected. The "Wan-li-chang-chüng" (or ten thousand "li" wall) is at this point about 20 feet in height by, say, an equal width (I did not take any actual measurements), and is of earth faced with masonry; it is flanked by numerous square "cavaliers," or watch towers, from whose crenelated battlements the Chinese braves in olden times doubtless kept watch and ward against the barbarians of the north. The wall is in fairly good preservation at this point, and as far as one could see it stretched in an unbroken line to east and west. Its most striking characteristic, perhaps, is the relentless manner in which it pursues its way up hill and down valley, over crag and mountain crest, undeterred by rock or fell, here spanning a mountain torrent, and there apparently vanishing into the clouds as it became hid in the mist-covered mountain-top; it seemed as though those old Chinese builders must have simply revelled in overcoming the difficulties which Nature placed in their way, and one could not but speculate on the manner in which this gigantic undertaking had been carried out.

Evening was drawing on as we descended the pass and entered the village of Ma-tsui, a place which derives its importance from its being the headquarters of the mandarin in charge of the gate in the Great Wall through which passes the main route between the two important provincial towns of I Chau and Hsuen-hwa Fu. There is quite a large yamen here, and though the mandarin was away at Hsuen-hwa Fu, his subordinate very politely provided us with rooms in the yamen, and we exchanged calls and were on excellent terms. There is a break in the chain of mountains at this point, and a picturesque jumble of hills flanks the road, making Ma-tsui a place of considerable strategic value. The wall appears to split in two here and encircle the village and its environs, for towers and walls met us at every turn, and there were at least three gates at different quarters of the compass. A particularly striking view was afforded by a temple perched on the top of a low conical hill, its walls being coloured a bright pink, which, contrasting with the dark indigo foliage of the fir trees that clustered round, and the light green of the grassy hillside, made a bright and characteristically Eastern picture. I was up early the next morning, and bribed a sleepy and tousled Chinaman to accompany me up one of the more accessible hills to a tower on the wall, whence a magnificent view of the country before us was obtained; range beyond range of hills stretched before and beneath us, and one could clearly trace the course of a river, which, I was assured, was the only practicable route in the direction in which we wished to go. A careful reconnaissance with the field-glasses corroborated this opinion, and I was able to get a good idea of the route we were to follow, though I was disappointed to find that the eternal ranges of hills effectually prevented any view of the Wu-tai-shan mountains, which I had hoped would be visible from here. It was a perfect morning, and the scenery was delightfully varied and picturesque; numerous mule caravans were coming up the pass, laden with charcoal and cloth and other merchandise, each mule with a basket-work muzzle on his nose, which was usually decorated with a gaudy crimson rosette, whilst the leading animal carried a deep-toned bell, from which proceeded a hoarse but melodious jangle as the plucky little beast stepped lightly over the rocky path. Starting early, a few miles brought us to the river I had espied from the wall that morning, and inquiries proved that it was identical with the tributary whose course we had followed to Se-shih-ko, so that we had gained but little by our flank march to Peng-taw. Our road now turned north-west, which was the direction I was anxious to pursue, and, keeping parallel with the river, crossed a fine park-like stretch of ground dotted with walnut trees and orchards of pear and date trees. A brief halt for lunch was made in a shady clump of trees adjoining the track, and then, pushing on for a mile or so further, we entered a narrow defile between steep and frowning hills, where our troubles began. The going soon became atrocious, and for the most part the track was indistinguishable from the stream, sometimes running up one bank and sometimes the other, and more often than not meandering in the bed of the stream itself. Huge boulders and shingle paved the way. For 5 stony miles we dragged our weary shins through this pitiless defile until, just before dark, we reached Ta Miao, a tiny village which was destined to mark the limit of our progress northwards. The people here were kindly disposed ragamuffins, who stated that we were the first foreigners they

MOUNTAINS NEAR THE GREAT WALL, WITH WHITE ROCK AND VILLAGE OF NANG-SHI-KO IN FOREGROUND.

had ever seen—a statement which they corroborated by the inordinate curiosity they displayed, men, women, and children all crowding round the camp and watching my smallest movement with the deepest interest. Like the inhabitants of all the villages we had passed through since entering the mountains, they seemed extremely poor and ignorant, whilst there were an extraordinary number of persons suffering from goitre; I estimated the proportion of those afflicted with this disease at about 20 per cent., and I fancy that is a moderate estimate. Their clothes were of the poorest description and often in rags, and in many cases they hardly knew the value of the dollar and its subdivisions which are current throughout the Treaty Ports and their surrounding districts. The villagers seemed so anxious to oblige us, that we did not grudge them the harmless but rather irritating amusement of gazing on us at every possible opportunity.

But it was now time to count up the days remaining for the return journey, and to decide on our next move. As I was already in some danger of overstaying my leave, I decided to turn back and make with all haste for the nearest point on the railway, which it seemed was near I Chau. This settled, I engaged mules, and we returned as quickly as possible over the road we had already surveyed until we reached a point some 3 miles inside the Great Wall, where the road diverged from our former route, and where it was accordingly necessary to again take up the survey.

The character of the country had now begun to change; the valleys were broader and the hills lower, with the result that cultivation was more general and the roads far easier, and the next day we made capital progress during the forenoon. At mid-day, however, we again struck one of the tributaries of the Chu-ma Ho, and following this on its southward course, the going became so shingly and rough that even such hardened pedestrians as we were were reduced to a slow and wearisome crawl. At night we camped at the village of Yu-taw-tsun, and on resuming our march next day we soon found that the going improved rapidly, and that in fact we were now entering a far less sterile district than we had hitherto met with. By 10 a.m. we rejoined the main stream of the Chu-ma Ho, which had now lost its wild and dashing character, and was a broad but shallow river only a foot or two in depth, so that there was no difficulty in crossing it. A few miles beyond the river we reached Pan Chŭng where Abbaz Khan's party were awaiting us, and after a brief halt we all travelled on together. The Chinese were in capital spirits at the thought that the hard marches were now nearly over, and that they were soon to be back in the land of pork and rice, and, the road being smooth and level, we made good progress and reached Ling-tze-nan by nightfall.

Our march from Ta Miao had been so rapid that we were now said to be only some 18 miles from Liang-kaw-chuang, the nearest point on the railway, and I had some hopes of getting there next day. Hitherto we had been following the main caravan route from Ma-tsui to I Chau, but we now left it, partly in order to avoid a high pass we were told of, and partly because I wanted to stick to the river as long as possible for the sake of the survey. Foot passengers and traffic apparently preferred the shorter route, and our road was therefore deserted and solitary. A few miles further and we bade a final farewell to the Chu-ma Ho, whose course we had followed so long, and with whose clear cold waters we had such an intimate and personal acquaintance; and after crossing some low hills we entered a beautiful woodland glen where oak and birch and other familiar trees gave a peculiarly homelike aspect to the scenery; the autumn tints were on the leaves, and after the rugged mountain scenery we were used to, the easy slopes covered with shady graceful trees were a delightful change. The "close" nature of the country was not, however, favourable to rapid surveying, and it was not till 4 p.m. that we finally cleared the woods and found ourselves in a narrow valley between low rolling grass-covered hills. There were no signs of cultivation, and, with the exception of a few solitary huts at intervals of a mile or so, the place was uninhabited, whilst long grass that reached to our knees stretched before and around us as far as the eye could see. It was a curious and very unusual type of scenery for this part of China, where the plains are usually dusty and cultivated on every square inch; but the mystery was afterwards explained when we found that we were approaching the ancestral tombs of the emperors of China, and that these solitary grass-covered valleys formed part of the "Chin-ti" (or forbidden ground), which is reserved as a sort of "buffer state" to protect the tombs from the evil spirits of wind and water which are popularly supposed to come from the north. No one is allowed to settle or to cultivate land in this area, and the huts we saw were those of the watchmen appointed to guard these preserves. I was surprised to find that no objection was raised to our passing through, but apparently the road is free to all, and indeed the next day we met crowds of coolies going to cut grass, so that presumably the reservation is not a very strict affair. We pushed on as rapidly as possible, but by dusk there was still no sign of any village to be seen, and we were therefore obliged to camp for the night in company with the evil genii of the place, who, however, did not indulge in any special manifestations for our benefit. A short walk next morning brought us to the railway at Liang-kaw-chuang, and our journey was ended. The railway at this point is a small branch line especially constructed for the conveyance of the emperor and his suite to the imperial tombs on those occasions, usually every alternate year, when he goes to worship there. The solitary morning train had left before we arrived, and as we therefore had to wait till next day, we sought the hospitality of a large lama temple close at hand, where the lamas (for a consideration) gave us capital quarters and every attention.

The time was now come to return to Tien-tsin, and, in conclusion, it may not be out of place to glance briefly at the results of the expedition. The actual journey, from the time of our leaving the railway at Cho Chau to the day of our arrival at the western tombs, had taken just fourteen and a half days, during which time we had marched 150 miles, which, deducting the day spent in climbing Peak No. 23, which is not included in the mileage, and also allowing for the day's halt at Pong-taw, gives an average of about 12 miles a day. That we did not achieve a greater speed than this is due, firstly, to the fact that a route survey was kept up the whole way, and, secondly, to the extremely rough ground we traversed, and to the numerous fords, which occasioned a great deal of delay during the first half of the journey.

This comparatively slow progress and the short time at our disposal necessarily limited the scope of our operations, and, realizing this, we made a point of, at any rate, doing our work thoroughly as far as it went, and accordingly we tried to make the survey as connected and continuous as possible, an attempt in which we were so far successful that we were able to map the Chu-ma Ho pretty thoroughly the whole way from Chang-fang to where we left it near the western tombs, and as this happened to be an unexplored part of its course, our work was of some value. Its main tributaries were also explored to some extent, and surveyed with sufficient accuracy to enable a very fair idea to be obtained of the general system, and incidentally we obtained a traverse of the rather important trade route between I Chau and Ma-tsui. From the tourist's point of view the journey proved an unqualified success, for from first to last we travelled through picturesque mountain scenery of the most striking description, and the continual exercise, combined with the rough healthy open-air life, made us as hardy and "fit" as could be, so that, as I involuntarily remarked to Abbaz Khan on the day that we returned to Tien-tsin, we were fit to walk anywhere.

Finally, I must not fail to give a word of hearty acknowledgment of the services of my fellow-travellers. Abbaz Khan showed himself throughout an industrious and careful surveyor and an intelligent and reliable subordinate, whilst the Chinese members of the party distinguished themselves by their unfailing good humour and readiness to do whatever was wanted of them. They were always cheery and full of jokes and laughter, and throughout the journey it was very rarely that I had occasion to find fault with any of them. I have already spoken of the kindliness and civility of the villagers amongst whom we sojourned from time to time, and on the whole my experience during this autumn holiday gave me a strong impression of the good nature which is undoubtedly one of the leading characteristics of the Northern Chinese.

THE VOYAGE OF THE "NEPTUNE" IN NORTHERN CANADIAN WATERS.

We have received the report of the Department of Marine and Fisheries for 1904, containing the account by Mr. A. P. Low of the voyage of the Government steamer *Neptune* in 1903–4 to Hudson bay and the archipelago to the north of it, to which reference has already been made in the *Journal*. The account is only a preliminary one, and will be followed by a full report embodying all the results of the voyage, but enough is said to show the importance of the latter for a better knowledge of the lands and seas touched upon. The surveys, which were carried out wherever practicable, and extended in all to over 2000 miles of coast, have permitted many rectifications of the charts to be made, while Mr. Low's qualifications as a geologist render his observations on the nature of the formations met with of special value. Other results are soundings, observations on the state of the ice at different times of the year, extensive natural history collections, and a regular series of meteorological observations, besides studies of the Eskimo tribes met with. The *Neptune*, which is one of the best steamers of the Newfoundland sealing fleet, was commanded by the experienced ice-navigator, Captain Bartlett, to whose skill Mr. Low bears willing tribute. One of the primary objects of the expedition was the enforcement of Canadian jurisdiction over these northern territories, an officer and detachment of N.W. Mounted Police being especially sent for this purpose.

The settlements on the shores of Cumberland gulf, in Baffin Land, were first visited, the ship's head being then turned southward along the south shore of the gulf *en route* for Hudson strait. The coast is there very bold and broken, with bare rocky cliffs rising from 500 to 1000 feet above the sea, and higher ground behind. The coast is deeply indented by long narrow fiords, and a boat-channel can be followed from Blacklead to Cape Haven station, behind a series of bold rocky islands. Rounding the south point of Resolution island, the *Neptune* followed the north shore of Hudson strait, passing close to the Saddleback islands, which were found to be double the number marked on the chart. The ship also passed over the doubtful Griper shoal, without any indication of its presence. Many icebergs, driven into the strait by the south-east winds, said to have prevailed all the summer, were seen. After touching at Erik cove, a good harbour just east of Cape Wolstenholme, a course was laid for Cape Fullerton, through Evans and Fisher straits, south of North Southampton island. Bell island, composed of granite and limestone, was the most desolate-looking country Mr. Low had ever seen. Heavy ice was encountered on its coast. Further on, the location of Tom island on the chart was passed without any indication of it from the soundings. It was decided to winter at Fullerton, where the *Era*, an American whaling schooner, was already in winter quarters. Meanwhile Mr. Low proceeded in the launch to Chesterfield inlet, to procure supplies from the Eskimo there. On the return journey the launch grounded and capsized, but news was fortunately conveyed to the ship by means of the dingy. The dangers of this uncharted coast are considerable, the *Neptune* grounding twice out of sight of land while on the way to fetch back the party. The harbour at Cape Fullerton froze over on October 16, and preparations were made, by building a wall of snow-blocks round the ship, to secure the comfort of the crew during the winter. In the spring exploring work was commenced. During April and May, Mr. Wager made a survey of the coast from Cape Fullerton to and around Wager inlet; Mr. King, assisted by Mr. Ross, made surveys of the harbour and approaches to Fullerton, taking many soundings through holes bored in the ice. In June, Mr. Low and Dr. Borden made a trip to Southampton island (of which formal possession was taken), examining about 50 miles of coast north of Cape Kendall. The ice was still solid on the coast, and, like much of the land, was covered with deep snow, rendering travelling next to impossible. During the winter the weather was quite severe at times, the average temperature in February being as low as $-27°·8$, while the lowest minimum, which occurred in March, was $-53°$.

A start was finally made in the *Neptune* on July 18, and a course was laid for the south-west end of Southampton island (presumably the southern island of that name), which was found to be placed on the charts at least 40 miles too far south. The ship was once more beset during the passage through Hudson strait, but soon got free, and the voyage was continued up the coast of Greenland, and across Melville bay to Smith sound, a visit being paid to Peary's former headquarters at Etah. Crossing over to Ellesmere island, some heavy Arctic ice, which had passed down through Kennedy channel, was encountered. Formal possession was taken of Ellesmere island, near the site of Peary's last headquarters, and again at Cape Herschell, on the return voyage southward, which was commenced without delay, heavy ice being again met with.

Mr. Low's report gives some interesting details as to the configuration and geological structure of the Arctic coasts hereabouts. From Cape Sabine to Cadogan bay (where the coast is very different from that laid down on the charts) the land is high and bold, and the shores deeply indented. The amount of ice and snow was much greater than on the Greenland side. Only prominent capes are partly bare, and inland there appears to be a continuous ice-cap, discharging many glaciers. Granite rocks extend south to Cape Isabella, where they are replaced by bedded sandstones, identical with those of Northern Greenland, though Mr. Low is inclined to think them older than the age assigned to the latter. At Cadogan bay these again give place to Laurentian granite, which, as the voyagers proceeded up Lancaster sound, was capped with horizontal beds of Silurian limestone, the country then becoming a flat tableland, with an abrupt, deeply cut, coast. Shelter was sought in one of the bays, the water being for 10 miles too deep to anchor, and the cliffs rising to a height of 1500 feet. The furthest west was at Erebus harbour, Beechy island, Franklin's winter quarters before passing westward on his last fatal voyage. Here the record left by Captain Amundsen, already referred to in the *Journal*, was found. No ice could be seen to the westward in Barrow strait, the prospects for a north-west passage appearing particularly favourable, though lack of instructions precluded the attempt.

At Beechy island a proclamation, taking formal possession of North Devon for the Dominion, was again read, and the *Neptune* was once more headed east, passing down the coast of Baffin Land, and visiting the quarters of the whalers and Eskimo at Pond's inlet and elsewhere. The latter describe the interior as less forbidding than would appear from the coast. Deposits, apparently of Tertiary age, and containing lignite, occur on this coast; and though there is probably no workable coal, Mr. Low considers it possible that alluvial gold may be associated in these deposits. Before finally sailing homewards it was necessary to once more visit Fullerton, in order to communicate with the police detachment left there; and the passage through Hudson strait gave an opportunity for carrying out further surveys. A sounding alongside of Salisbury island (which rises abruptly to perhaps 1000 feet) gave no bottom at 230 fathoms, this being the deepest water with the strait. Some Eskimo encampments were visited, and books distributed, some of the people having learnt to read from other natives, who in turn had been visited by native agents from the mission stations. The *Neptune* reached Halifax on October 11, 1904, after an absence of a year and fifty-one days.

REVIEWS.

EUROPE.

Ports of North-West Europe.

Die nordwesteuropäischen Welthäfen.' Von Dr. Kurt Wiedenfeld, Privatdozent der Staatswissenschaften an der Universität Berlin. Berlin. 1903.

This volume owes much of its material to a journey undertaken by the author in the autumn of 1901 under the patronage of the Berlin *Institut für Meereskunde*. Its purpose is a detailed study of the commercial position and future prospects of London and Liverpool, Hamburg and Bremen, Amsterdam and Rotterdam, Antwerp and Havre. Opening with a sketch of modern world-trade, by land and sea, before and after 1870 ("Die Organisation des Weltverkehrs in ihren Grundzügen," pp. 1-11), Dr. Wiedenfeld proceeds to consider the relations of the great harbours of North-Western Europe first to oceanic, and then to continental, commerce and intercourse, as well as to the general organization of modern trade ("Die Beziehungen zur Seeschiffahrt," pp. 12-267; "Die Handels-Organisation und die Beziehungen zum Hinterland," pp. 268-358). The text is followed by six plans—(1) of the Thames and Mersey estuaries; (2) of the mouths of the Weser Elbe, Seine, and Scheldt, and the communications of Amsterdam and Rotterdam with the ocean; (3-6) of the docks of London, Liverpool, Hamburg, Bremen, Cuxhaven, Bremerhaven, Geestemünde, Amsterdam, Rotterdam, Antwerp, and Havre. What is here illustrated by plans is described in the text with a thoroughness which leaves little or nothing to be desired. Dr. Wiedenfeld has done his work very well; he gives us here a detailed, but at the same time illuminating, account of the chief centres of modern oceanic commerce in North-Western Europe, and he studies with excellent result the general courses and conditions of that commerce so far as it is based upon these ports. The special connections of each centre—the special spheres of maritime trade-influence belonging respectively to London, Hamburg, Liverpool, and the rest—are carefully set forth; particular attention is given to the development of German commerce oversea; and the conclusion of a certain though very gradual decline in the *preponderance* of the British harbours is drawn with apparent fairness ("Nur Australasien kann heute als die fast unbestrittene Domäne des Londoner Verkehrs bezeichnet werden . . . London ist nicht mehr die Alleinherrscherin im Weltverkehr"). By the side of London and Liverpool, Hamburg, Antwerp, and Bremen have taken their place, and new developments of the highest import are being gradually prepared for in oceanic trade. C. R. B.

ASIA.

Eastern Colonial Methods.

'The Far Eastern Tropics. Studies in the Administration of Tropical Dependencies: Hongkong, British North Borneo, Sarawak, Burma, the Federated Malay States, the Straits Settlements, French Indo-China, Java, and the Philippine Islands.' By Alleyne Ireland, F.R.G.S. Westminster: Archibald Constable & Co. 1905. 8vo. Pp. 339. *Map.* 7*s.* 6*d. net.*

Mr. Alleyne Ireland, whose name is probably familiar to a good number of geographers as that of the author of 'Tropical Colonisation,' here presents us with a series of studies on colonial administration—the *avant coureur* of a much larger work on the same subject. Appointed by the University of Chicago in 1901 as a special commissioner for the purpose of visiting the various tropical colonies in Asia, and reporting on the systems of colonial administration, he has from time to time communicated articles dealing with these and allied matters to the *Times* newspaper. We cannot at the moment recall whether the volume under notice is an actual reprint of this series, or whether the latter merely served as the framework of the essays before us, but from the preface it would seem that some such amplification has been made. But, however it may be, no fault can be found with Mr. Ireland's resolve to put his views into more permanent form, for his subject is of unusual interest, and is one to which, hitherto, far too little attention has been paid.

The author—who, it should be stated, is a British subject, notwithstanding his American appointment—has, to begin with, a claim to a hearing if only on the score of his long and extensive investigations in the special field he has chosen;

but, as the reader soon discovers, this is by no means the sum of his qualifications for the discussing of the various systems he passes in review. Of these latter he gives a tolerably comprehensive selection, exhibiting a heterogeneity which is instructive to the student. We have, as may be seen on reference to the sub-title of the book, a small British Crown colony, which is, nevertheless, the largest port in the world, a merchant-company's venture in kingdom-keeping, a private white despotism, a province of India, a group of federated states administered "under the advice of a British Resident-General," a French experiment in Indian empire, Holland's ancient and most important Eastern possession, and America's latest colonial nurseling. Had Mr. Ireland only added German New Guinea, and compared the methods of administration of the three European nations owning that island, he would have rendered his subject altogether complete.

Excluding the Philippines, a chapter is allotted to each of the countries named above. The author uses them as standards of comparison whereby to gauge the methods and aims which have guided American statesmen in administering their new possessions in the Pacific, and concludes with four chapters on the latter, telling how the Philippines were acquired, how they are governed, what is their present economic condition, and what the policy which actuates their rulers. Finally, in the appendices a number of statistics are given from the recent Philippine census.

The book, as will thus be seen, is in the main what its sub-title implies, and would therefore seem to lie somewhat more in the realm of politics than geography. But this is by no means entirely the case, for the author always keeps in view the environment and the geographical why and wherefore of things, and his conclusions are thus of distinct interest. Mr. Ireland's style, moreover, is conspicuous for clarity of reasoning and expression, and his criticism is so eminently characterized by sound common sense and acute observation that he should carry conviction in the minds of most of his readers. Apart from a curiously involved sentence which opens chapter x., Mr. Ireland is quite French in the clearness and neatness of his argument—a rare enough characteristic in these days of hasty writing. Owing to the condensation necessary in bringing so wide a subject into so restricted a space, the volume does not readily lend itself to detailed review, but some of Mr. Ireland's remarks are particularly instructive, and demand a word of notice here. Taking the English possessions, he is evidently of opinion that where failures arise they are brought about in most cases by the interference of the home authorities. Thus, whereas in the case of Sarawak he finds himself "unable to express the high opinion I have formed of the administration of the country without a fear that I shall lay myself open to the charge of exaggeration," in Hongkong and British North Borneo, on the other hand, the persistent ignoring of the views of those in command on the spot evokes sharp criticism. In the former colony the system of indexing the official correspondence is described as one of utter confusion, and in no one place is there a complete set of the printed records of the colony, thus showing marked contrast with Java, where he found more perfect methods of work, a more thorough system of records, and a more intelligent appreciation of the functions pertaining to a colonial secretariat than he met with in any other of the countries he visited. Yet Mr. Ireland has no preference whatever for the Dutch system of educating Indian civil servants as against ours; indeed, he thinks it distinctly faulty, the examinations being directed almost exclusively to a knowledge of local and technical subjects. It seems, nevertheless, as most persons acquainted with the Netherlands India will testify, to be attended with remarkably good results.

The four chapters devoted to the Philippines are a good exposition of the difficulties which confronted the Americans on taking over the archipelago, and how they attempted to deal with them. Their aim, as Mr. Ireland well puts it, was the introduction into a community, whose social and political conditions were the product of the superimposition of mediæval European ideas upon tropical tribalism, of an administrative system representing five centuries of growth beyond the mediæval stage, and depending for its success upon a homogeneity of which scarcely a trace existed in the islands. Side by side with excellent intentions there existed an ignorance of the broad established data concerning tropical administration, and an absence of information as to the work of the European nations in neighbouring colonies which was deplorable. The whole future of the Philippines Mr. Ireland conceives to lie in the labour question, and the outlook, he thinks, is not encouraging. The natural resources of the islands can never be made accessible to mankind without the use of imported labour, to which, of course, America is strongly opposed. The new owners of the land have failed to grasp the importance of the environment, and, in trying to make the Filipino into an American, have lost sight of the fact that every natural circumstance which has made American civilization what it is is non-existent in these tropical latitudes. Pending the appearance of Mr. Ireland's larger work, which is to be issued in ten or twelve volumes in America during the course of the next four years, the book before us may be cordially welcomed as an interesting study in outline of what is practically a novel subject. If the author's suggestion be adopted that a post, or posts, of inspector of colonies should be created, the duties of which would consist in visiting our oversea possessions in rotation, and investigating the work and methods in vogue, probably few persons could be found more fitted for such an appointment than himself.

F. H. H. G.

Through China to Burma.

Unter Chinesen und Tibetanern.' Von A. Genschow. Rostock i. M.: C. J. E. Volckmann. 1905. Pp. vi. and 384. *Maps and Illustrations. Price 6s.*

The author went south from Peking to Hankow, then west to the Tibetan border, and on to Burma *viâ* Atun-tze and Talifu. Beyond Ichang he (like Colonel Manifold on his latest expedition) crossed the mountains south of the Yangtse instead of following the river. On the Tibetan border he travelled for the most part by routes already followed by Captain Gill, the members of the Davies-Ryder survey expedition, and others. Between Atun-tze and Tali, however, he seems to have been in part on new ground, so that some additions to our knowledge, in points of detail, have resulted from the journey.

AFRICA.

A French Expedition to Lake Chad.

Commandant Lenfant, 'La Grande Route du Tchad.' Mission de la Société de Géographie. Paris: Hachette. 1905. Large 8vo. Pp. 288. *Maps and Illustrations. Price* 12 *francs.*

In this work the well-known French explorer gives a detailed narrative of his successful expedition to Lake Chad by the Benue route, the main outlines of which had been given to geographers in his paper read last year before the Paris Geographical Society, and summarized at some length in the *Journal* (vol. 24, pp. 202–206, with map). The material there presented has been amplified in the present work, but the main conclusions are necessarily the same, so that it is superfluous to speak of them in detail. The book bears abundant testimony to the thoroughness and enthusiasm for his work which have distinguished Captain

Lenfant throughout his whole connection with Africa. He has always an eye for the physical processes which have in course of time moulded the surface features of this part of the continent, and his explanations of its past physical history, though at times dependent, perhaps, on hypothesis, are based on a thoughtful and intelligent study of the problems presented. It is from this point of view that his work has the greatest interest to the geographical student. The possibilities of water-communication from the Atlantic to Lake Chad, which have been acclaimed with so much enthusiasm as established by his expedition, will hardly perhaps stand the test of calm and unbiassed reflection; and even before the journey now described had been made, it was sufficiently obvious that the Benue route would be the most feasible to the French Central Sudan, once it were conceded that an all-French route might be dispensed with. The tracing of the physical connection between the basins of the Niger and Shari, so long suspected but never before clearly elucidated, is, on the other hand, a decided contribution to our knowledge of African geography. The phenomenon of a water-discharge in two different directions, such as takes place, at high water at least, from the Tuburi marsh, is by no means unknown to geographers. But it is sufficiently uncommon for every new example to be of interest, and this is heightened, in the case of the Shari and Benue systems, by the somewhat special features which have been found to exist. Thus the Tuburi swamp lies on the elevated plateau of Central Africa, and, while the drainage to the north by the Logone never leaves that plateau, the western outlet has worn itself a deep channel through its outer edge, and makes its way to the lowlands drained towards the Atlantic ocean. We thus seem to witness the early stage of an erosional process whereby the whole Shari basin might, in the course of ages, find an outlet to the sea.

Besides sketching, in various interludes interspersed in the narrative, the broad characteristics of the physical geography, as well as the ethnography, of the region, Captain Lenfant repeats the conclusions arrived at in his former paper as to its economic possibilities which, in spite of all optimism, certainly do not seem over-attractive. The book is profusely illustrated by photographs and drawings, and its own merits might have entitled it to dispense with the laudatory prefaces, which seem, however, to be considered a necessity in French works of travel.

AMERICA.

MEXICO.

'Le Mexique, au début du XX^e Siècle.' Par MM. le Prince Roland Bonaparte, Léon Bourgeois, Jules Claretie, d'Estournelles de Constant, A. de Foville, Hippolyte Gomot, O. Gréard, Albin Haller, Camille Krantz, Michel Lagrave, Louis de Launay, Paul Leroy-Beaulieu, E. Levasseur, le General Niox, Alfred Picard, Élisée Reclus. Two volumes quarto. *Maps and Plates.* Libraire Ch. Delagrave, Paris.

Under various headings, this is a compendium of the present condition of Mexico—population, political institutions, agriculture, mines, industry, public works, post and telegraph, finance, foreign relations and geography. All of these subjects are handled with that skill, lucidity, and comprehensive grasp characteristic of the talented experts whose names are above given.

Mexico is much reduced from the original area which it had when Cortez gave it to the crown of Spain; but it still has 767,000 square miles. Its population has greatly increased during the last forty years, and now numbers about 14,000,000. Prince Bonaparte divides it into whites 20 per cent., mixed 40 per cent., and Indians 40 per cent. From personal observation over two-thirds the area of the country I am disposed to change these proportions into whites 10 per cent., mixed races 30 per cent., pure blooded Indians 60 per cent.

It is worth remark that the great President Benito Juarez, who finally broke up the baneful rule of the priests and inaugurated the present era of Mexican progress, was a pure-blooded Zapoteco Indian, while the existing President Porfirio Diaz, who had so wisely guided the progress of his country, is largely of Indian extraction. An observant traveller must recognize in many parts of Spanish America that the virility of the Indian blood seems to be reasserting itself, in the same way that the ancient Roman blood appears to be slowly coming to the front again in Italy. It may be said to-day that the average Mexican is prouder to count his descent from some *cacique* of the days of Montezuma than he is to trace some Spanish *conquistador* among his ancestors. He is developing a civilization of his own, and this is perhaps confirmed by Prince Roland Bonaparte: "Immigration is much inferior to that which existed in the colonial epoch. In fact, at the commencement of the last century, when Mexico had but about 6,000,000 of inhabitants, there was a minimum of 60,000 Europeans there, the great majority of whom were from the Iberian peninsula, and consequently were called *peninsulares*. To-day there can be found but 50,000 individuals proceeding from Europe and the United States and belonging to the white race;" and he closes with a remark, with which we cannot agree, "Frankly, this is a deplorable state of things; it should be remedied." Then follows a contradictory statement: "In the neighbourhood of the United States the Mexican population is rapidly becoming more strongly compact, which will permit it to resist, in case of need, the infiltration of North Americans so often announced." It was the idea of Louis Napoleon, in his invasion of Mexico, that the advance of the Anglo-Saxon in the New World should be curbed.

A valuable and useful chapter deals with the past and present agricultural conditions of the country and its future possibilities, while under the title of "Mines" we have an exhaustive treatment of the wonderful mineral wealth of Mexico, and how it is being developed. The article on "Industry and Commerce" must command attention from those who suppose that Mexico is only a land of minerals.

Perhaps under the heading of "Railways and Public Works" we may judge best of the modern advancement of Mexico. The first railway was completed in 1867, the year of the downfall of the Maximilian empire. It is 424 kilometres long, and connects the capital with the port of Vera Cruz. In 1901 the total length of lines opened for public traffic was 14,534 kilometres. Telegraph lines have also rapidly increased in number. In 1867, "after the retreat of the French Intervention and the settling down of the Republic," the Government took in hand the extension of the few short private lines then working, and by the opening of the present century it had 31,346 kilometres in operation. "To-day," says Lagrave, "there is not in Mexico any populated centre of medium importance which is not served by a telegraph line."

M. de Foville illustrates his articles with engravings of ancient and modern Mexican coins. He gives the silver exportation in 1878 at 24,836,903 dollars, and in 1901 at 74,326,406 in coin and ingots, and the gold exportation for the latter year at above 9,000,000. M. Leroy-Beaulieu, with a masterful pen, outlines "Finances" from the date of the independence of Mexico to the present time. In 1866 the receipts of the national treasury were but 5,057,000 dollars, and the average of four years did not exceed 6,500,000. From 1868 to 1877 the average receipts were 16,611,000 dollars yearly. At the latter date General Porfirio Diaz *assumed* the presidency. For the financial year 1901–1902 the income of the treasury was calculated at 61,694,000 dollars, but it must not be overlooked that in the mean time silver had sunk to one-half its previous value. The foreign trade was, in 1902–1903, 220,010,811 dollars in imports, and 219,402,064 in exports. Internal finance and foreign loans are comprehensively treated, and M. Leroy-Beaulieu closes his chapter with the following tribute to Mexican administrative talent:—

"This Latin Republic makes a good figure by the side of the great Anglo-Saxon Republic. It shows its ability to preserve its physiognomy, its traditions, its originality, and to do honour to the Latin race."

Public instruction makes marked and healthy advancement, both as regards primary and higher education, while art and sciences are by no means forgotten; and M. Claretie tells us of the great strides which literature has made since the days of President Juarez. Mexico now has four academies—languages, jurisprudence, science, and history.

General Niox states that the effective army consists of 3500 officers, 31,000 men, and 11,000 horses; but that Mexico could maintain a force of 140,000 men.

The work closes with a very instructive chapter on "Foreign Relations" from the date of the independence of the country until the present time. It calls attention to the *Monroe Doctrine*, the result of Canning's efforts to get the United States to join England in a declaration "against all attempts hostile to the independence of the ancient colonies of Spain."

Campaigning with Juarez against the empire, I recall that the imperial army was always accompanied by an artist, whose business it was, whenever the troops of Maximilian captured a city, to paint a crown upon the head of the eagle of the coat-of-arms of Mexico which was always found over the doorway of Government buildings. Our ragged, patriot force could only afford a common soldier with a paint-pot; and, whenever we retook a city, it was his duty to daub out the emblem of royalty. He may not have been so good an artist as the one who painted it, but he did his work thoroughly, for he felt that he was making a Spanish-American translation of the Monroe Doctrine.

George Earl Church.

POLAR REGIONS.

Early History of Spitsbergen.

'Early Voyages to Spitsbergen in the Seventeenth Century.' Edited, with Introductions and Notes, by Sir W. Martin Conway, F.S.A. London: Hakluyt Society, 1904. 8vo, pp. 191. *Maps and Illustrations.*

Though not concerned with any of the more important voyages of northern discovery (which have been dealt with pretty fully in previous publications of the Hakluyt Society), this volume supplies some interesting information, not readily accessible elsewhere, on the doings of the English, Dutch, and Biscayan whalers in the early part of the seventeenth century. The longest and most important items are (1) a reprint of Hessel Gerritsz's rare tract, published in French at Amsterdam in 1613, in which, besides a sketch of the discovery of the islands and a description of their general character, the grievances of the Dutch whalers against their English rivals are set forth at length; (2) the journal, by Van der Brugge, of the successful wintering in Spitsbergen of seven Dutch seamen in 1633–34. With the exception of the wintering in the same region of the seven English sailors whose experiences were related by Edward Pellham in 1631, this was the first occasion on which the rigors of the Arctic climate had been successfully endured during a winter in Spitsbergen; so that the details of the daily life of the hardy seamen, and the observations on the natural phenomena of that remote land which are recorded by Van der Brugge, will be read with much interest. Both these narratives now appear for the first time in an English version. Sir Martin Conway supplies brief introductions to each of the pieces he has printed, thus linking together the events dealt with into a more or less connected narrative. It is the history of whaling enterprise, rather than of geographical discovery, that is kept in view throughout, and it might be wished that the editor had said more on the latter subject. Thus a brief summary of the conclusions reached by him with regard to the voyages of Barents and Hudson, already dealt with in the *Geographical Journal*, would have been useful, as would also a general map of the Spitsbergen group, the only part included in the one inserted being the extreme north-west. This was, it is true, the special field of activity of the Dutch whalers, but other parts of the group come also into question incidentally. The editor has paid much attention to the elucidation of the complicated nomenclature of Western Spitsbergen, and his conclusions will help materially towards an understanding of these early voyages.

Reproductions are given of John Daniel's map (1612), used by Gerritsz to illustrate his treatise; of the chart of Maurits bay (the scene of the Dutch wintering), published in 1655 in Doncker's 'Lichtende Columne;' and of the title-pages and illustrations belonging to Van der Brugge's Journal, and to another which appeared a year later. These illustrations, it should be remarked, are pretty close copies of certain of those in De Veer's account of Barents' voyages.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Geological Processes.

'A Treatise on Rocks, Rock-weathering, and Soils.' By George P. Merrill. London and New York, 1904. Pp. xx. + 411.

The space devoted to the three divisions of this work follows the order indicated in the title; 171 pages of text are devoted to rocks, 127 to rock-weathering, and 100 to soils. The first part is an abbreviated treatise on petrology, which covers the same ground as many other text-books. The second is the important part of the work, and the collected analyses showing the constituents which disappear in the weathering of different types of rocks are especially useful. In the third soils are treated solely from the geological side—that is, with reference to their mode of origin. In this part we notice one curious omission: though the action of ants and termites in carrying organic matter down into the soil is referred to, no mention is made of earthworms. Are there no worms in America?

THE MONTHLY RECORD.

EUROPE.

Evolution of the Map of Scotland.—Mr. J. E. Shearer, F.S.A. Scot., has contributed the first instalment of a paper on this subject to the June number of the *Scottish Geographical Magazine*. The subject of the early cartography of the British Isles has never been adequately dealt with in the light of modern knowledge, the accounts given in the older works, such as Gough's 'British Topography,' being necessarily deficient in certain directions, in which recent research has added to the sources of information. But while the subject is thus one which lends itself to further discussion, and Mr. Shearer's paper will be of use in calling attention to one portion at least of the field, it can hardly be said that his treatment of it is entirely satisfactory. While possessing a considerable knowledge of early maps of Scotland, he occasionally shows a deficient grasp of the general course of cartographical progress during the middle ages, which leads him to choose as types maps that were perhaps second or third hand copies from earlier examples, or at least were unimportant representatives of their class. In particular, he passes over the whole field covered by the portolani of the fourteenth and fifteenth centuries (apart from a second-hand reference to them in a quotation from Nordenskiöld), many of which were far in advance of the printed maps of even a later date. As an instance of the delineation of Scotland as an island by continental map-makers, he chooses the map in Bordone's 'Isolario' of 1528, though this is, of course, quite a late instance of this feature. In regard to early English maps, again, he lays somewhat undue stress on the insular character assigned to Scotland, the delineations of Matthew Paris and others bearing witness to the vague idea of a close approximation, in the neighbourhood of Stirling, of arms of the sea by which the opposite coasts were pierced,* but hardly to a definite belief in a continuous waterway. Even in the Hereford map the dividing channel is named *river* Tweed (Fl. Twede), while in many of the early portolani (based, no doubt, on English information) a distinct dividing-line is shown across the waterway. Mention might have been made of the map in the Venice Ptolemy of 1511, which shows Scotland with correct orientation from north to south. A knowledge of this (with other maps of the early sixteenth century) would have obviated the misstatement that Leferi (*sic*) was "the first printer (after Ptolemy's Britain of 1478) of maps of this country." The paper contains reproductions of several of the maps alluded to.

Distribution of Population in Brittany.—Attention has frequently been called to the influence exerted by the sea on the grouping of population in Brittany, which is strikingly seen in the comparatively dense aggregations on the seaboard, and the marked sparseness of population on the interior plateau. A more detailed study of the facts and causes of this distribution than had previously been made has lately been undertaken (under the guidance of M. de Martonne) by M. E. Robert, who presents the results in the *Bulletin de la Société Scientifique et Médicale de l'Ouest* (vol. 14, No. 1, 1905), reprinted as No. 4 of the *Travaux du Laboratoire de Géographie de l'Université de Rennes.* The author points out that neither the geological structure, the relief of the soil, nor yet the hydrography, are such as to account in themselves for the observed facts of distribution, their tendency being to induce throughout a segregation of the population into isolated settlements; a tendency favoured, too, by the lack of well-developed communications. Statistics show, however, wide differences between different cantons, and these are seen to be due mainly to the relative positions of the areas with regard to the coast, the geological structure being perhaps identical. They are not so much due to the existence of large centres along the coast-line, as to the relatively close proximity to one another of the small settlements, which also show a marked air of prosperity and animation as compared with the interior hamlets. It is the sea, by supplying means of contact with the outside world, which has been the source of this relative activity and progress on the borders of the peninsula. In order to bring out this influence as clearly as possible, M. Robert has divided the whole of Brittany into zones of equal distance from the coast, calculating the average density for each of these and showing them on a map by a scale of tints. Difficulties are of course encountered in the attempt to determine the actual population of each zone, especially from the fact that the individual communes sometimes extend into two if not three different zones. This particular difficulty has been met by distributing the population of the communes in proportion to the number of hearths recorded

* It is not quite correct to call these the Firths of Forth and Clyde, the latter river, with Glasgow, being shown further south, though the most pronounced firth on the west side has been misplaced northwards.

within each zone. M. Robert's study, to analyze which in detail would carry us beyond the limits of space available, enters into other questions beside the influence of nearness or distance from the sea. Thus the whole area is subdivided into natural regions, and the special factors in each which may tend to modify the general law are clearly brought out. A word of caution as to the conclusions to be drawn from the map is perhaps advisable, otherwise a mistaken impression might perhaps be carried away. It must be remembered that by the mere choice of the particular mode of subdivision adopted (by which the actual course of the lines dividing different densities is determined), the facts corresponding with this are emphasized at the expense of other possible principles of distribution, which are liable to be left out of sight. To take an example, we may suppose an area in which the population is concentrated into several parallel river-valleys running at right angles to a coast-line, becoming, however, less and less dense as the distance from the sea increases. On the basis adopted by M. Robert, the successive densities would be shown as running in zones parallel to the coast, while had the division been made by lines perpendicular to the latter, we might have obtained a series of bands running in this direction, and representing the varying densities of the river-valleys and uninhabited tracts between them. In each case the fact brought out is a real one, but another of equal value is disregarded.

The Oeschinensee in the Bernese Oberland.—An unusually careful examination of the limnological features of the Oeschinensee—a small mountain lake at an elevation of 5188 feet—has been carried out by Dr. Max Groll, of Berlin, who has described his researches and their results in a brochure of seventy-eight pages, with maps and sections (Bern: Haller'sche Buchdruckerei, 1904). Dr. Groll set about his task, which occupied him at intervals from 1901 to 1903, with characteristic German thoroughness. Finding the features of the lake-shores not delineated with sufficient exactness for his purpose in the official maps, he himself undertook a careful large-scale survey with the aid of Herr Schüle of the survey department at Bern. In order to fix the positions of the soundings with the greatest possible accuracy, ropes, marked at intervals of 25 metres, were stretched across from shore to shore, and soundings taken at the points of subdivision. The level of the lake surface was carefully noted from day to day, and the soundings all reduced to a uniform datum. They were taken only during calm weather, and are estimated to have a probable error of only $\pm$ 5 cms. (about 2 inches). The lake is regular in outline, measuring, at high water, 1860 yards by 1088. Its maximum depth, 185 feet, is above the average for lakes of its class. The water was at an unusually low level on the occasion of some of Dr. Groll's visits, and he was able to recognize by ocular inspection the three different zones defined by Forel, viz. the shore-zone, the steep slope ("Halde"), and the floor. In the case of the Oeschinensee, the first-named zone merely continues the morphological features of the shore above water, its angle of slope depending on the size of the detritus of which it is composed. The more or less level floor occupies more than one-third of the whole area. The chief morphological elements are calculated as follows:—

	At normal level.	At low water.
Area	0·45 square mile	0·33 square mile
Length of shore-line	3·2 miles	2·5 miles
Shore development	1·5	1·2
Volume	1,410,000,000 cub. feet	882,000,000 cub. feet
Greatest depth	185 feet	136·5 feet
Mean depth	113·5 feet	96·7 feet

Dr. Groll enters fully into the rise and fall of the lake (the lowest level was observed in March, the highest in September); the transparency (greatest when the water is lowest, as then the influx of sediment practically ceases), and colour (due when blue to the purity of the water; when green, to the presence of matter in suspension, and possibly also in solution); and, especially, to the temperature conditions, to an explanation of which he pays much attention. Some of the more striking points brought out are as follows: (1) a cooling sets in in autumn, both on the surface and in the lower layers, while a *rise* of temperature is observed at intermediate depths; (2) the temperatures remain in winter virtually constant under the ice; (3) at the end of winter a slight rise of temperature was observed beneath the ice, while that of the lowest layers continued to fall. This rise Dr. Groll considers to be due to the entrance of water from the mountain streams. The depth to which the upper layers of lakes may be cooled below the temperature of maximum density he likewise attributes to the access of cold water heavily charged with sediment, which therefore sinks below the level at which its temperature would otherwise cause it to rest.

ASIA.

A New Indian Province.—It has been felt for many years that the enormous and rapidly growing population of Bengal, and the expansion within it of commercial and industrial enterprise, have placed a burden on its existing administration which, in the interests of efficient oversight over the whole of the vast area, urgently needed lightening. The subject was brought to the front as a practical question by a letter addressed by Mr. Risley, Secretary to the Government of India, to the Bengal Government in December, 1903, in which a sketch was given of the various suggestions which had been made to cope with the difficulty, and of the measures advocated after full discussion by the Central Government. These have since received careful consideration by the local authorities interested, which have in the main given their cordial support, making, however, suggestions on minor points which have, in many cases, been accepted by the Government of India. A final decision was reached in a resolution of the latter, dated Simla, July 19, 1905, by which Bengal is relieved of an area carrying a population of over 24 millions, out of a total of 78½. This important step has not been taken without earnest consideration of the interests involved, and though it has aroused opposition in some quarters, the means adopted certainly appear the best that could be devised for the end in view. The transfer of territory which has been made is somewhat complicated, involving various adjustments between contiguous areas. Of the administrative divisions bordering on Bengal, the Central Provinces and Assam were alone in a position to add to their existing responsibilities. Both Orissa and Chutia Nagpur have in the past come under consideration as parts of Bengal which might suitably be transferred to the Central Provinces, and in the case of the latter a partial adoption of this idea has resulted in the transfer of the five native states, forming a solid block with Hindi-speaking population, which have hitherto been attached to the division, but, owing to their remoteness, have not received the administrative attention they need. The British districts of Chutia Nagpur are retained under the Bengal Government principally from commercial considerations. As regards Orissa, with its Uriya-speaking population, it has been felt that its transfer to another government would involve insuperable difficulties, while the completion of the east coast railway has brought the division into closer relations than ever with Calcutta. But not only is Orissa left with Bengal, but in deference to the widely felt desire on the part of the Uriya-speaking peoples to be united under one administration, a considerable area (including the greater part of the Sambalpur district) has been transferred from the Central Provinces to the Orissa division. The net relief to Bengal on the south-west is therefore not great, and more radical changes on the east were necessary in order to gain the desired end. It has therefore been decided to cut off the whole of Eastern Bengal (including, besides Dacca and Chittagong, the districts of Rajshahi, Dinajpur, Jalpaiguri, Malda, and Chittagong), and to unite it with Assam to form a new administration of the first class, to be known as "Eastern Bengal and Assam," with the status of a lieutenant-governorship, and possessing a Legislative Council and Board of Revenue, though remaining under the jurisdiction of the High Court of Calcutta. The province will have an area of 106,540 square miles and a population of 31 millions, with its capital at Dacca, and subsidiary headquarters at Chittagong. It is pointed out that it will have a well-defined western boundary corresponding with well-recognized geographical, ethnological, social, and linguistic characters; that the typical Mohammedan population of Bengal will be concentrated in a single province; and that practically the whole of the tea industry and the greater part of the jute tracts will be brought under a single government. The whole of the Assam-Bengal railway will also fall within the new province, and it is hoped that a great impetus will be given to the development of Chittagong as a natural outlet for the trade of Assam and Eastern Bengal. A Parliamentary paper has been issued containing the memorandum of December, 1903, and the recent resolution of the Indian Government.

The Franco-Siamese Boundary.—The delimitation on the spot of the new boundary fixed by the agreement of last year between the Gulf of Siam and the Great Lake of Cambodia has been in progress for some time, and in spite of difficulties which have arisen in the course of the operations, a line has been at last adopted which has received the approval of both sides (*B. Comité de l'Asie Franç*, July, 1905, with map). The course which the line would have taken had the strict letter of the agreement been followed, proved unsuitable from the French point of view when the country was examined, and in their desire to arrive at a lasting settlement the Siamese commissioners, after some demur, accepted a revision of the frontier in several localities, the result in each case being to add somewhat to the territory assigned to France. In the Krat region, instead of leaving the coast at Cape Lemling (in which case the full value of the anchorage assigned to France between Koh Chang island and the mainland would, it is said, have not been realized), the boundary has been shifted to the southern shore of the estuary of Paknam Ven. It then runs across to the Klong Yai, follows this stream and ascends the Klong Reng to the Cardamom mountains, running due south for some distance along these, and then striking nearly due north again. This leaves a narrow wedge of Siamese territory within that of France, and it is to be expected that this will give occasion in the future for a further demand for a rectification. Further east the frontier has again been shifted north so as to follow the upper course of the Mung river (an affluent of the Great Lake) before striking across to the Prek Kompong, which forms the dividing-line to the south of the lake.

Mr. F. H. Nichols' Journey across China to Tibet.—We recorded last year (*Journal*, vol. 24, p. 677) the unsuccessful attempt made by Mr. F. H. Nichols, an American traveller, to penetrate Tibet from the east. After reaching Rangoon *viâ* Bhamo, Mr. Nichols went to India and entered Tibet by way of Darjiling and the Chumbi valley, but died on reaching Gyangtse without realizing his design. The June number of the *Bulletin* of the American Geographical Society contains notes from Mr. Nichols' diary, kept during his journey through China from Ichang to Ta-chien-lu, which show him as a capable observer and add to the regret that he was unable to carry out the work which he had set himself. Unfortunately, the notes cease before the arrival at Chiamdo, where the traveller was on less-known ground, and where he spent many months in preparing himself for his intended journey by the study of Tibetan.

Morphology of the South-West Coast of Sumatra.—During journeys as a geological expert on the little-frequented south-west coast of Sumatra, in the middle and southern parts of the Benkulen residency, Dr. J. Erb was able to add somewhat to our knowledge of the physical history and features of this coast, hitherto based on rapid reconnaissances only. As regards the geological formations (mostly of late Tertiary age), while not discovering any not previously known from Sumatra, he verified the existence on the west coast of some that had previously been known on the east only. Structurally, the two coasts show a marked contrast, in that the Tertiary formations are folded and thrown into anticlines on the east, while on the west the strata are merely inclined at a low angle, as they pass under the Indian ocean. The movement which gave rise to the present coast-line in Pleistocene times took place here mainly in a vertical direction, the lateral pressure which folded the rocks on the east having been absent. The present coast originated in a system of longitudinal faults, accompanied by a rise of Southern Sumatra relatively to the Indian ocean. The south-east to north-west direction of the coast is parallel to the general direction of the volcanic zone of the central range, and to the Pleistocene folding in the Palembang residency, as well as (apparently) to the system of folds in the Barisan range. Among the agencies by which the coast has been and is being modified, the principal are the heavy surf, and the coastal current which runs towards the north-west, or in the opposite direction to the ocean current outside the line of the Engano and Nias islands. It corresponds, however, with the direction of the most prevailing winds, which from May to September are the south-east trades along the whole southern section of the west coast. Dr. Erb says that the cause of the current is the oblique direction in which the waves strike the coast, though this again would be due to the direction of the wind, which would be the primary cause of both phenomena. A result of the current is a general transport of shingle along the coast, a fact which can be observed at many of the river mouths, which have been diverted to one side. It is only in the case of rivers of intermediate size that this is observable, for while the largest rivers have sufficient power to sweep away obstructions, the small streams become blocked at their mouths by shingle, through which the water finds its way in great part by percolation. With its few bays and the total absence of serviceable harbours, this coast offers few inducements for settlement, and even fishing is very little practised along it. Dr. Erb discusses the nature of the coral reefs which extend along a portion of the coast, and brings together a considerable number of facts bearing witness to a recent elevation of the island, or a portion of it, holding that the want of uniformity which has evidently characterized this movement is a reason for rejecting the idea that a recent fall in the level of the Indian ocean has taken place.

The Khatanga Expedition.—The July number of *Petermanns Mitteilungen* records the arrival of the Tolmacheff Expedition at Lake Yessei in April last, after a journey in which great cold had been experienced. The route had been laid down with the help of ten astronomically fixed points, and much had been done to throw light on the river-systems of this part of Siberia. Among the streams explored were the Kotui, the main head-stream of the Khatanga, the Kureika, and the Severnaya, a tributary of the lower Tunguska, which is fed in part by a lake lying in 68° N. Lake Yessei was found to lie 2° further south than it has been hitherto placed. The explorers purposed to go south to the second lake-source of the Khatanga—the Monero—and afterwards to explore the group of small lakes known as Voyevoti. After descending the Khatanga to the sea, the various members of the expedition hoped to return by different routes, the leader crossing the Vilui region to Olekminsk, while Baklund would make his way by Lake Yessei and the old route of Middendorf along the limit of forest growth to Dudino.

AFRICA.

The Segonzac Expedition in Morocco.—The Marquis de Segonzac, whose recent travels and captivity in Morocco were referred to in the May number of the *Journal* (vol. 25, p. 564), has since been released and has safely returned to France, accompanied by his coadjutors, MM. Gentil and de Flotte Rocquevaire. Some account of the work accomplished by the expedition, which, in spite of the leader's imprisonment, was on the whole a decided success, has appeared in the *Bulletin* of the *Comité de l'Afrique Française* for May last. The greater part of M. de Segonzac's own route has already been briefly described in the *Journal* (*loc. cit.*). His objects were, in particular, to study the two versants of the central main range of the Atlas, and the connections between this and the Middle and Anti-Atlas; the possibilities of communication between south-east Algeria and southern Morocco; the economic resources of these regions, their inhabitants, and political and religious relations. After crossing from the sources of the Muluya to the south side of the main Atlas by the Tunfit pass, at the foot of Jebel Aiashi, M. de Segonzac made his way to the headwaters of the Dra, through the territory of the Ait-Atta, belonging to a religious brotherhood independent of those of Tafilet (left by the traveller on his left) and the upper Dra. From Tamgrut he went due west along the southern edge of the anti-Atlas, through a semi-desert region broken by the valleys of the right-bank affluents of the Dra, and inhabited both by settled Berbers and by nomad Arabs. Great insecurity reigns in these regions, and the traveller's imprisonment was due to his being denounced to a band of professional pillagers, the Uled ben Tabia. His release was finally secured by Sheikh Hamu-ez-Zenagi, chief of the powerful Zenaga tribe, and he was able to save his notes and the greater part of his collections. His return journey was made across the last northern spurs of the Anti-Atlas to the remarkable circular plain of the Zenaga, and on by Tazenakht and Tikirt, through an interesting region in which a friendly welcome was extended to him as a French traveller. He has brought back scientific observations of all kinds. The journeys of M. Gentil, the geologist of the expedition, promise equally valuable results. Besides a short expedition in the neighbourhood of Tetuan, he made three separate journeys in the western part of the main Atlas and the coast region south of Mogador, making many observations on the geology and topography. The third journey, which entailed considerable hardships, led south from Demnat across the range, during the passage of which M. Gentil was fortunate enough to discover the first fossils by which it will be possible to determine the age of the ancient axis of the range in these parts. On the southern slope, too, he met with the remains of a fine Carboniferous fauna. Passing through Tikirt, he examined the neighbourhood of Jebel Sirwa, whose granite base supports well-preserved remains of volcanoes, apparently of Tertiary age. Further Carboniferous fossils were found on the return route to Marakesh. M. de Flotte Rocquevaire was entrusted with the triangulation of the Huz and the western part of the Atlas, and his labours will be of great value for the co-ordination of the work of previous travellers, which have hitherto lacked a common basis. Bearings were taken from sixty-six stations, and the co-ordinates of about 300 positions carefully fixed.

AMERICA.

Vicissitudes of an Eighteenth-century Map.—Mr. Henry N. Stevens has brought out an interesting pamphlet setting forth the surprising vicissitudes through which a map of the British American colonies passed during the latter half of the eighteenth and the early years of the nineteenth century. The original map was prepared by Lewis Evans and published at Philadelphia in 1755, accompanied by a quarto pamphlet supplying an 'Analysis of a General Map of the Middle British Colonies in America.' The map, which measures about 26 inches by $19\frac{1}{2}$, was on the approximate scale of 36 miles to the inch, and much care was bestowed on its preparation, an immense amount of information having been collected by Evans for the purpose. The pamphlet drew attention in particular to the need of checking the French encroachments and the advantages to be gained from the establishment of settlements on the Ohio. The general state of affairs in North America rendered the map of special interest at the time, and some copies were sent to England and issued in London by R. and J. Dodsley. It soon attracted the attention of the map-publisher, Thomas Kitchin, who practically copied, re-engraved, and published it in 1756, professedly with improvements, though these are by no means manifest. This was but the first of a long series of piratical re-issues, which were continued to at least as late as 1807, when, for the fifth time, the old plate, prepared by Kitchin in 1756 (which had subsequently passed into the hands of Thomas Jefferys), was utilized for 'A New and General Map' of the Middle States of the Union, all mention of Evans's name being now omitted from the title. But this was not all. In 1771 the original map had for the second time been re-engraved on a new plate, this time by Carington Bowles (equally without licence from the representatives of the original author), and this plate did duty for three successive issues, the last being possibly as late as 1800. In 1776 a corrected version of Evans's original map and pamphlet was prepared by Governor Pownall, who had throughout taken much interest in Evans's work, and who devoted the proceeds to the benefit of the daughter of the latter, who had been left in straitened circumstances. Thus in the course of half a century no fewer than ten separate versions of this 'Map of the Middle British Colonies' saw the light, of which eight were piratical issues published without any real attempt to bring the subject-matter up to date. The history of the map, the elucidation of which has involved a good deal of persevering research on the part of Mr. Stevens, throws a striking light on the methods too often employed by cartographers, who have exploited the ignorance or indifference of the public to their own profit.

AUSTRALASIA AND PACIFIC ISLANDS.

New Caledonia.—The report in the *Oesterr. Monatsschrift für den Orient* (Feb., 1905) of an official journey to New Caledonia by the Austrian consul in Sydney furnishes some useful data on the physical and political geography of the island. Contrary to the general custom, the review of the political state of the island precedes the account of its physical geography; and such is here the right order scientifically, the political factor being in this instance more the key to recent modifications of the physical geography than *vice versâ*. The picture drawn of the motley ethnical elements, a feature in which New Caledonia has, perhaps, no match, is not flattering to present European civilization. In the last twenty-five years the native population has been reduced from 50,000 to 20,000, and, given a continuance of present conditions, is likely to be quite extinct within the next fifty years. A handsome and strong race, habituated to unrestrained freedom, and satisfying at light cost all their economic wants, the Kanakas will not adapt themselves to a culture which for them means only hard and ungrateful toil in mines, factories, and wharfs, obnoxious European dress, and alcoholic vitiation. The white population numbers 26,000. Of these, 8000 belong to the official class, garrison, and the "better classes." In the penal institutions (now in process of abolition) there are now only 2000 inmates, the rest of the whites being free settlers and workmen. To the common and political criminals transported there have been added, since 1885, *relégués*, including beggars, drunkards, in short, the element the least advantageous for colonization. The criminal population, still bound to the island after a term of punishment, poisons the whole atmosphere morally. The redeeming feature in the working population are the Dalmatian and Croatian immigrants, a sound and sober people. They are, however, always intent on higher wages, and will any day throw up steady employment for the chance of a small enhancement. Earning each seven francs a day, and able to live in affluence on three, they yet restrict their food to potatoes and bread. The specially geographical section of the article includes a review of the natural resources and actual products of the island, imports and exports, industries, and more particularly mining.

POLAR REGIONS.

Return of the Ziegler Polar Expedition.—The *Terra Nova*, which sailed for Franz Josef Land early in the present summer for a renewed attempt to rescue the members of the Ziegler Expedition, returned to Tromsö on August 10th, having successfully accomplished its mission. During the northern voyage the ice-field was sighted on June 19 in 75° 57′ N., 36° 26′ E., and was entered on the 24th somewhat further east. The conditions were unfavourable, and the advance was much impeded by fog, but Salmi island was eventually sighted on July 28, and Cape Dillon reached the next day. Here six men of the missing expedition were found, and despatched on sledges to Mr. Fiala's headquarters, while the ship proceeded to Cape Flora, where twenty-one men were taken on board, afterwards returning to Cape Dillon, where the remainder of the expedition was embarked. The *Terra Nova* sailed homewards on August 1, getting clear of the pack after some difficulty on the 6th. It was fortunate for the members of Mr. Fiala's party that the relief expedition of the present year was not, as was the case last year, driven back by the ice without reaching its destination. The *America*, in which the original expedition sailed in the summer of 1903, was lost in the ice, with a large part of the stores, during the first winter, and had not the depôts left by former expeditions been found and made use of, the result might well have been disastrous. As it was, many hardships had been experienced, and there seems little doubt that many of the party would have succumbed to an enforced wintering for a third time in those regions. It will be remembered that the avowed object of the expedition was to reach as high a northern latitude as might be, and if possible to carry the American flag to the north pole. It has therefore been a failure as far as this object is concerned, no latitude approaching that of Nansen's or Cagni's furthest having apparently been reached, every effort to advance north being, according to the telegrams, frustrated by the unfavourable conditions. It has apparently been little more successful than the earlier expedition under Prof. Baldwin, whose failure to reach a high latitude aroused so much criticism; and this though it had the advantage of the preliminary work done by the latter, for to the depôts established by him it mainly owed its safety after the loss of the *America*. Some good scientific work is, however, said to have been done by Mr. W. J. Peters, of the U.S. Geological Survey.

Peary's Start for the North.—The *Roosevelt*, with Peary's expedition on board, sailed from New York on July 12 for the final attempt on the pole to be made by the gallant explorer. The whole equipment of the expedition has been organized in the most thorough manner, and no stone has been left unturned in the determination to ensure the greatest chance of success. The *Roosevelt*, as has been already stated in the *Journal*, has been specially built for the purpose, and is unusually fitted to withstand heavy ice-pressure, while the engines are powerful enough, it is hoped, to force a way through the heaviest ice. It is Peary's intention to take the ship to as high a northern latitude as possible, preferably on the north coast of Greenland or Grant Land, and from this base to advance north in sledges in February, 1906. As on previous occasions, he relies mainly on his Eskimo coadjutors for the success of the northern journey. The ship is provisioned for two years, and in the event of failure to reach a sufficiently advanced position during the present year, the final attempt will be postponed until February, 1907. A novel item in the outfit is an installation of wireless telegraphy, by the aid of which, with intermediate stations to be established *en route*, it is hoped to keep in touch with civilization until the sledge journey commences.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Causes of Ocean Currents.—This question, about which so many divergent views have been held, but which has of late years come to be regarded as virtually solved by the supposed demonstration of the preponderating influence of atmospheric currents, has been once more approached in a determined way by Dr. Nansen, who, in the first three numbers of *Petermanns Mitteilungen* for the present year, has discussed the fundamental problems connected with the existence of ocean currents, and sought to arrive at an explanation which shall harmonize both with theoretical considerations and with observed facts. The experience gained during the voyage of the *Fram* has given the illustrious explorer an unusual insight into the conditions of the problem, and some of his conclusions have already been put forward in the 'Scientific Results' of that voyage. But he has since continued his investigations and tested them by laboratory experiments, so that his discussion starts from an unusually firm basis. So complicated, however, is the subject, and so many the disturbing factors which tend to vitiate conclusions based on mathematical theory, that it will probably be long before any explanation can be universally accepted as final. To give one instance only. The coefficient of friction in the case of water has been calculated experimentally by physicists at 0·014; yet, as Dr. Nansen shows, the results obtained on this basis may, in certain cases, be so paradoxical as to show that in the case of ocean currents this figure is quite untrustworthy, and that the opposition to motion caused by friction, vortex motion, waves, and so forth may be 10,000 or even 100,000 times as great as has been supposed. Nansen differs fundamentally from most recent writers on the subject in his view that the influence of winds on currents, especially as regards their direction, is of comparatively slight importance. He shows that the effect of the Earth's rotation in causing a deviation from the direction of the wind has been entirely overlooked by Zoppritz and his followers, and that this fact vitiates all their results. Not only is it impossible for a wind (except on the equator and in special circumstances due to the influence of land-masses) to bring about a current coinciding with it in direction, but the vertical effect is also much less than has been supposed, and Dr. Nansen holds that currents started by winds must be more or less local or temporary in character. It is, in his view, the temperature difference between the equator and the poles which is the virtual agent in the production of currents, though winds may have considerable influence on their rate. In this case, too, the influence of the Earth's rotation in causing a change of direction is, of course, most important, and this is examined with great care and thoroughness in the second of the two papers, the conclusions being based on actual experiments with a rotating vessel containing water. From these, Dr. Nansen passes to a consideration of the case of a globe uniformly covered with water, in which the difference of specific gravity would give rise to a current running in a spiral direction towards the pole, the transfer of water from the equator to high latitudes being retarded in proportion to the length of the course to be traversed. The existing main ocean currents can be explained as due to the modifications introduced by the existence of the continents. The last paper deals with currents due to evaporation and precipitation, especial note being taken of the influence of ice-formation.

GENERAL.

The Successor to Dr. E. Richter at Graz.—Dr. Robert Sieger has succeeded the late Dr. E. Richter as Professor of Geography at the University of Graz. The newly-appointed professor, who is already well known to geographers, was born in 1864 at Vienna, where he studied history and oriental languages at the university, and took his doctor's degree in 1886. He subsequently devoted himself to geography, which he studied under Simony, Kiepert, and Richthofen, and made two journeys for research in Scandinavia, giving some of the results in a paper on 'Lake-level Variation and Coast-changes in Scandinavia,' published in the *Zeitschrift* of the Berlin Geographical Society in 1893. Since that date he has written on a variety of geographical questions, including the fluctuations of the African and Armenian lakes, the physical history of the Lake of Constance, the "Karst" forms of glaciers, and other subjects. In 1898 he became A.O. professor at the newly founded "Exportakademie" in Vienna, and since 1903 had occupied the same post at Vienna University.

OBITUARY.

Elisée Reclus.

On July 4, Elisée Reclus died in his seventy-sixth year in a small Belgian village not far from Ostend, and the most sympathetic articles which have been devoted to him since in the press of all nations bear testimony to the extremely wide popularity as a writer, and the profound esteem as a man, which the great French geographer enjoyed in all civilized countries.

Jean Jacques Elisée Reclus was born on March 15, 1830, in a small town of the Gironde Department, Ste.-Foy-la-Grande, and his family have never broken their association with this part of south-western France. His father was a Protestant pastor—a man of great integrity of character and remarkable energy. So was also his mother, who reached a very great age, teaching in a school of her own foundation, and retaining wonderful mental energy till her very last days. Elisée was the second of a family of twelve, all of whom, brothers and sisters alike, have left their mark in life. His elder brother, Elie, became a well-known anthropologist, one of his brothers is a geographer, another an engineer, and one a surgeon of great repute. One of his sisters, Madame Dumesnil, was for the last twenty years his constant help in all his work.

Elisée Reclus received his first education in Rhenish Prussia, and later on he entered, with his brother Elie, the Protestant Faculty at Montauban. Their father's intention was to make of them Protestant ministers. Neither of the two brothers felt, however, inclined to follow the vocation of their father. Karl Ritter was attracting at that time students from all parts of Europe by his wonderful generalizations concerning the Earth and its inhabitants, and both brothers, leaving Montauban in 1849, went to Berlin, making most of the journey on foot, and living chiefly on bread and fruits. The lectures of Ritter, like the works of Humboldt, undoubtedly left a deep impression upon all the subsequent work of Elisée Reclus. The Earth always appeared to him as a living being in its continuous variations, and the inhabitants of its different parts were intimately connected in his mind with the physical characters of the portion of the globe where they had developed; while the influence of Humboldt's poetical ways of interpreting Nature and describing it is evident in Elisée Reclus's style.

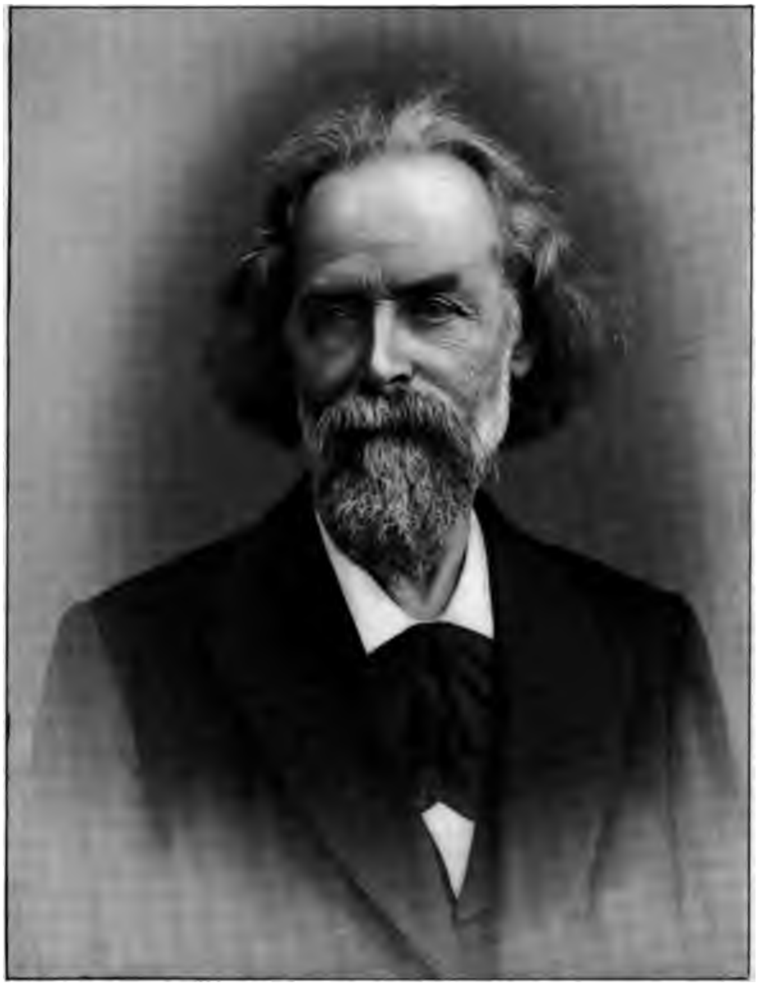
After the *coup d'état* of Napoleon III., Elisée Reclus, as well as his brother Elie, were compelled to leave France. He came to London in 1852, then stayed in Ireland, and finally went to America, where he visited the United States, Central America, and Columbia. This last journey he described in a charmingly written little book, 'Voyage à la Sierra Nevada de Sainte Marthe' (Paris, 1861).

Returning to France in 1857, Reclus took a lively part in both the scientific revival and the political movement which characterized the middle of the nineteenth century. These were the years when, by a series of monumental works, the foundations were laid of the mechanical theory of heat, the kinetic theory of gases, modern atomistic chemistry, the variability of species and modern biology altogether, anthropology, physiological psychology, and so on; while the political revival which took place after the Crimean war led, as is known, to the liberation of Italy and the abolition of serfdom in Russia, and slavery in the United States. Reclus contributed his part to both these movements. The need of good popular works in all branches of natural science was deeply felt at that time, and in 1864 he published (besides an 'Introduction au Dictionnaire des Communes de France') an extremely well written little book—which he considered later on as his favourite work—'Histoire d'un Ruisseau,' in which he gave quite a course of geography by following a stream from its birth till it becomes a mighty river and an artery of human intercourse. The substance of the method which Reclus followed later on with such a success in his 'Universal Geography,' was thus contained in this 'History of a Brook.'*

Three years later, in 1867, appeared the first volume of his 'La Terre: Description des Phénomènes de Globe,'† which at once conquered for him a place of honour amongst geographers. This work, which is a necessary introduction to the 'Universal Geography,' is a true product of the scientific revival of those years, and represents an admirably told physical geography. The life of the continents, their distribution on the globe, their architectonic features, the laws governing their outlines, as well as the distribution of the plateaus, the lowlands, the deltas, and the deeply indented peripheric regions, all these problems of comparative earth knowledge are dealt with, and the corresponding features described with admirable lucidity in the first volume of 'La Terre.' The oceans and the atmosphere were dealt with in a subsequently published second volume. All the characteristics of Reclus's geographical work appear already in 'The Earth.' He pays just as much

* There is no English translation of the 'Histoire d'un Ruisseau,' and of its companion book, 'Histoire d'un Montagne.'

† This work has run through five or six editions, and has been translated into all languages, including English.



Photograph by J. Thomson.

ELISÉE RECLUS.

attention to geotectonic and geological hypotheses as is required for the comprehension of the Earth as a living planet; and he excels especially in the treatment of the slow modifications of the surface (perhaps without reaching the concreteness of the illustrations which we find in Lyell's 'Principles of Geology'), and in the description of the aspects which the Earth's surface offers now to its human inhabitants. Altogether, there is no better guide for one who wishes to be familiar with physical geography (or physiography) than these two volumes. None could, at the same time, be a better source of inspiration of love of the subject, as well as love for Nature in general. The numerous small maps in the text add immensely to the suggestiveness of the book, while its style is such that it reads as a work of art.*

When the Franco-German war broke out in 1870, and Paris was besieged, Reclus joined the National Guard, attaching himself to the battalion of aëronauts which had been formed by his great friend, the photographer Nadar, and he aided him in that remarkable organization of the pigeon-post and the ballooning which kept the besieged capital in regular intercourse with the provinces unoccupied by the Germans.

Later on came the Commune of Paris, and Elisée Reclus, refusing, in accordance with his opinions, any place in the Government of the Commune, went as a soldier in the ranks of one of the battalions of the *fédérés*. On April 5, 1871, he took part in a sortie towards Versailles. and, after the defeat of the column, was made prisoner on the plateau of Chatillon. He lived through all the horrors of the Satory camp and the pontoons of Brest, and was considered as irretrievably lost after the terrible experience of the transport of the prisoners to Brest, which resulted in the loss of reason and life for so many of his companions. However, he soon recovered, and founded a school for his working-men comrades in the prison of Quelern, teaching them reading, geography, and English.

In November, 1871, he was condemned by a Council of War to transportation, but was released in the following January, after a representation in his favour had been made by scientific men of different nationalities, especially English—Darwin, A. R. Wallace, Carpenter, and many others having signed the petition. His condemnation was commuted to perpetual banishment.

After his release, Elisée Reclus went to Zürich to rejoin his brother Elie; then he stayed for a time at Lugano, and finally settled at Clarens. The first work he wrote in Switzerland was another admirable little book, 'Histoire d'une Montagne'—a companion volume to his 'Histoire d'un Ruisseau'—in which he expressed his gratitude to the beautiful Nature of the Swiss mountains for healing the deep wounds which his mind had received during the civil war.

Soon after that he undertook his main work, the 'Géographie Universelle: la Terre et les Hommes,' of which the first volume began to appear in weekly parts in 1876. Beginning with Greece as the cradle of our present European civilization, and treating in succession from east to west the European peninsulas of the Mediterranean, Reclus described next France, then Central Europe, North-Western Europe (Belgium, Holland, and these isles), the Scandinavian lands, and European Russia. Europe took thus five volumes. The next five volumes were given to Asia, Russia in Asia, Japan and China, Farther India, British India, and South-Western Asia. One volume was given to Australia and the Pacific islands, four to Africa, and the last four to the two Americas.

* Elisée Reclus had himself written condensations of 'The Earth' in two small 18mo volumes, published at the low price of one franc each. These, again, have not been translated into English.

For nineteen years in succession Reclus brought out with astonishing regularity these bulky volumes, and there was not one single week in which the part which was due did not appear. The immensity of labour accomplished by Reclus during these years is alone a matter of wonder, the more so as he found also time to travel, and visited during that time several of the countries with which he was dealing. The amount of work which he was performing every day was colossal. Each volume of his work covered from 800 to 900 large octavo pages, and contained from 200 to 230 small maps in the text, and for each of these volumes Reclus consulted an average of 900 to 1000 volumes. Very often a volume was read and annotated, only to add a few words to the description of a valley or a mountain pass, or to choose a more characteristic adjective in the description of a range of mountains. As soon as one volume was out Reclus immediately began the next one, and by the middle of the year the fundamental manuscript, which usually represented one-half, or maybe less, of the final text, was ready. It contained the framework of the volume. All main lines, all generalizations were established. All the characteristic features of a given region were recorded in the proper terms. Its general structure, its mountains, and the characteristics of each river-basin, with its populations, industries, roads, and cities, or its successions of lacustrine basins and the wild tribes inhabiting their banks, were traced in broad, characteristic, well-chosen traits in this first manuscript. Then came the filling up of this framework with details: the beauties of hill and dale in this spot, the work of erosion of such a river, or the action of the sea on this part of the coast, the more detailed characteristics of the different stocks of which all great nations are composed, the conquests or devastations of civilization, the interesting features of such a city, or of the roads connecting them—all these were introduced, giving more and more life to the broadly painted landscape. When one remembers that every line of the manuscript, as well as of the just-mentioned details, and of the corrections in the countless proofs which used to pass between the printers and the author were made in Elisée Reclus's own handwriting, one understands vaguely the immensity of the work. And while one sees that the framework has been constructed with all the powers of a great geographer, who holds all the features of the continent which he describes in his brain and imagination, trained by travel, colossal reading, and previous work, one also realizes that the details are often true jewels set into the main picture. The result was that two distinctive features of the 'Géographie Universelle' struck all those who have written about it,—the generalizing power of a geographical genius, and the richness of admirably told, characteristic details which reveal a true poet's capacity for understanding Nature.

Before the 'Universal Geography' had been written, the description of the different portions of the globe was very unequal. For different regions we had no general geographical sketch, and knew only the results of local explorations of certain parts of the region. But Reclus so well managed to utilize all the available materials that he gave us full harmonic pictures of the whole, and that, as has been remarked once in *Petermanns Mitteilungen* (Bd. 40, litt., p. 132), the mosaic character of the preparatory work had disappeared.

It is especially in the description of rivers and their drainage areas that Elisée Reclus excelled. Taking any of the great streams—the Volga, the Niger, or the Amazonas—we find the same method applied with full success. From the very first lines the reader obtains a general idea of the position and shape of the river and its basin. Then he sees the birth of the river with the wild mountains or marshy plateau round its cradle, and the more or less wild tribes which are dwelling, or used to dwell formerly, round its headwaters. Then we are told how the upper course of the river became the seat of small barbarian republics or monarchies, and how, finally, a powerful state grew up on its banks, concentrating several territories under its rule. The river is living in the legends of its present inhabitants, or in the hypotheses of the early geographers, or in the early historical records. And then, as we follow Reclus in his course down the river, we see the stream growing, we learn about the different civilizations that appeared or are appearing now on its banks, and we see the growing intercourse that is maintained now with other nations coming to its mouth. In short, we obtain a real living picture of a wide territory.

As to the style of Elisée Reclus, it bears distinct traces of the influence of both Karl Ritter and Alexander Humboldt, with a light veil of the poetical, imaginative mind of Southern France. All through that immense work the style conveys the impression of an intense energy of both feeling and thought. It is the comprehension of Nature of Goethe and of Shelley in his softest, less tumultuous strophes.*

Another distinctive feature of Reclus's 'Geography' is his profound respect for every nationality, stem, or tribe, civilized or not. Not only is his work free from absurd national conceit, or of national or racial prejudice; he has succeeded, besides, in indicating in every branch, stem, or tribe of the human race those features which make one feel what all men have in common—what unites, not what divides them. However, it must not be believed that such a broadly humane attitude led the writer to obliterate the racial or national peculiarities. Not only every European or Asiatic nation appears with its truly national characteristics, but even the smallest of the hundreds of tribes described appears with its own tribal character. This is so much so that one cannot but wonder how Elisée Reclus succeeded in describing so many tribes without repeating himself.

It must also be said that the human inhabitants of the globe are what interested Reclus most, much more than the animals and the plants, or the flora and fauna of past ages. The Earth as the abode of man, and what man has done and is doing of his abode, this is what absorbed his main attention.

The last volume of the 'Universal Geography' appeared in 1894, and by now, several parts of it have already had to be revised in order to follow the rapid developments of geography, anthropogeography, and demography. The volume dealing with France was entirely revised, and several others ('Russia' in the number) underwent partial revision. Besides, South Africa and China were completely brought up to date by Elisée Reclus and his brother Onésime, and were published separately with a few of the small maps.†

The 'Universal Geography' placed Reclus in the foremost rank of modern geographers, and the Royal Geographical Society awarded to him in 1894 its Royal Gold Medal.

As soon as Reclus had terminated his great work, he began to prepare a new one, in which the development of Man was to be traced in close dependency on his geographical environment.

"Man, like the Earth, has his laws," Reclus wrote in the "Parting Words," with which he concluded his 'Geography.'

"Seen from above and from afar, the diversity of features intermingled on the surface of the globe—crests and valleys, meandering waters, shore-lines, heights and

* In dealing with the 'Géographie Universelle,' I of course refer to the French edition; naturally much is lost of Reclus's delicate treatment even in the best translation.

† 'L'Afrique Australe,' small 4to, pp. 358, 1901; and 'L'Empire du Milieu,' small 4to, pp. 667, 1902.

depths, superimposed rocks—presents an image which, so far from being chaotic, reveals to him who understands a marvellous picture of harmony and beauty. . . . And if the earth seems consistent and simple amid the endless complexity of its forms, shall the indwelling humanity, as is often said, be nought but a blind chaotic mass, heaving at hazard, aimless, without an attainable ideal, unconscious of its very destiny? Migrations in diverse directions, settlements and dispersions, growth and decline of nations, civilizations and decadence, formation and displacement of vital centres; are all these, as might seem at the first glance, mere facts, nay, facts unconnected in time, facts whose endless play is uncontrolled by any rhythmical movement giving them a general tendency, which may be expressed by a law? That it is that it concerns us to know. Is the evolution of man in perfect harmony with the laws of the Earth? How is he modified under the thousand influences of the modifying environment? Are the vibrations simultaneous, and do they incessantly modulate their tones from age to age?

"Possibly the little already known may enable us to see further into the darkness of the future, and to assist us at events which are not yet. Possibly we may succeed in contemplating in thought the spectacle of human history beyond the evil days of strife and ignorance, and thus again behold the picture of grandeur and beauty already unfolded by the Earth.

"Here is what I would fain study according to the measure of my strength."

This new work Elisée Reclus completed in three large volumes, and it has begun to be published at Paris, by the Librarie Universelle, under the title, 'L'Homme et la Terre.' Only the first three parts (twelve facsimiles) are now out; but several chapters have previously appeared as separate articles in various reviews, and it is already possible to say that this new work will be an important contribution to that branch of Earth knowledge which is known as historical geography. The first chapters, dealing with primitive man, and next with the relations that existed between man and different animals which he has domesticated or used for the purposes of hunt, are already full of interest, and show already the advantages of Reclus's method. But the chapters of modern geographical history,—such as, for instance, "The Partition of China," published in the *Atlantic Monthly* in November, 1898, or various chapters of general interest published in the French reviews, *Société Nouvelle* and *Humanité Nouvelle*, entitle us to think that we shall have in the new three volumes an extremely valuable acquisition. Nobody but the author of the 'Universal Geography' was able to so deeply analyze the international problems arising from modern colonization, and the rivalries between the industrial nations for getting hold of new markets.

In the year 1892 Elisée Reclus, dissatisfied with the turn that affairs were taking in France, left Paris, where he was staying then, and settled at Brussels. There he devoted his energy to three different undertakings. One of them was the "Université Nouvelle"—a free university which he founded with the aid of a few collaborators, and in which he himself taught geography, while his brother Elie delivered a remarkable course of a hundred lectures on the origin and history of religions. Many men of mark joined this university, which probably would have taken a further extension were it not for the difficulty offered by the small comparative value of the degrees conferred by the Université Libre, so long as they were not recognized by the State as equal to the degrees conferred by the other Belgian universities. The École des Hautes Etudes of the Université Nouvelle continued, nevertheless, to accomplish good work.

The other preoccupation of Reclus was the construction of a globe on the linear scale of 1 : 1,000,000, and, as a step to it, the preparation of convex maps with a true representation of the orography. It is known that this idea is being worked at now by many geographers, and Elisée Reclus gave to it a great deal of his activity. He came over to London a few years ago, in order to speak before the Royal Geographical Society upon this subject. In connection with this work

Reclus established at Brussels a Geographical Institute. The idea of it was to create an institution which, like the great Gotha Institute, would collect cartographic and geographical information, publish geographical works of universal utility, and undertake to accomplish geographical works for private persons, public bodies, and States. And finally, Reclus worked at the above-mentioned great work, 'L'homme et la terre.'

Elisée Reclus terminated this work last summer, and—as if his overstrained energy had been sustained only by the great problem he had before his eyes—he began to suffer from repeated and strong attacks of heart disease. The first attack of *angina pectoris* he had had already in 1880, but they seemed to have left no traces, and for a number of years they did not return. Now, and especially after the death of his brother Elie, which took place at Brussels at the end of January, 1904, the attacks of the heart became more and more frequent and extremely painful. I went to see him last June at Brussels, and found him suffering very much during such attacks, but full of mental energy a few hours later. It was hoped by his family and friends that he might still recover, but in June last the disease and suffering became more and more acute. He retained, however, full lucidity of mind, and as late as Saturday, July 1, he dictated some notes for his work. In the morning of July 4 he breathed his last, enjoining that no sort of public demonstration be made at his burial, and that nobody but his nephew, Paul Reclus (son of Elie) should accompany his body to the cemetery. He was buried in accordance with his wish, and laid by the side of his brother Elie.

Elisée Reclus leaves behind him his aged widow, a daughter married in Algeria, and several grandchildren. He was married three times. The first time he married a Creole lady, by whom he had two daughters; one of them died not long ago. He knew in perfection what Victor Hugo described as *l'art d'être grandpère.* His first wife died a few years before the Franco-German war, and he married once more, but soon lost his wife, in 1874, at Lugano. He married for a third time in Switzerland, and his wife—a good botanist and entomologist—always accompanied him during the journeys which he made while he was writing the 'Universal Geography,' and fully understood the importance to science of the great work to which her husband was giving his life.

If Elisée Reclus was held in high esteem as a geographer, he was perhaps esteemed even more as a man by the immense numbers of persons of all nations who had known him. It was impossible to approach Elisée Reclus without feeling the elevating influence of his character—such is the unanimous verdict of those who knew him. The profound scientific honesty of his work was only a reflection of his high personal integrity, absolute disinterestedness, and unlimited love of truth, without any restriction, mental or otherwise, that had become his intimate nature. The sobriety of his life was marvellous. Bread and some fruit was all that he lived upon, even when he worked from six in the morning till eleven in the evening. It was also his favourite food. Apart from the need of warmth that he began to feel as he grew in age, he may be said to have had no wants. He knew how to die poor after having written wonderful books. And he knew how, having attained the high summits of fame, never to rule anybody and to remain the equal of his humblest collaborator and of every one he met with. He certainly was one of the finest specimens of civilized mankind, a man *free* in the purest sense of the word.

P. KROPOTKIN.

CORRESPONDENCE.

Railways in China.

Chatham, August 13, 1905.

HAVING had a certain amount of experience in railway reconnaissance work in China, perhaps I might be allowed to add a word on the subject to Major Davies's letter in the August *Journal*. Sir George Scott's remarks struck me as being very much to the point.

Railway location in unknown countries (and in known ones also) is only too often carried out in a very unsatisfactory manner. The correct method of doing it cannot be dealt with here, but the reconnaissance, if properly carried out by an expert in such work, is of the greatest importance and the most difficult part of the work. If carried out in the more usual way, it is a very expensive method of acquiring information and locating a railway.

Some people seem to imagine that by following a track through a country, and making a rough sketch as they go, they are surveying that country and carrying out a railway reconnaissance.

I have, unfortunately, had experience with the results of such work, and found the so-called "maps" quite useless and the reports misleading and sometimes entirely wrong. The money spent on such work is mostly thrown away, as also the larger sums spent on operations based on the supposed results of such work. I am afraid these remarks apply to a great deal of the reconnaissance work that has been carried out in China. In locating a railway maps are of assistance, but a railway can very seldom be located from a map, though its probable general direction might be indicated.

The object of the sketch-map made whilst reconnoitring for a railway is mostly to illustrate the report and make it clearer. It is useless for determining the cost of a railway, and it is only cost which decides whether a route is practicable or impracticable, as a railway can be built anywhere with sufficient time and money.

By "cost" is meant the combined cost of constructing and operating, the latter being just as important as the former.

E. BARNARDISTON, Captain R.E.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. *Rev. G.* **29** (1905): 103–108. **Letorey.**

Le glacier de Tête-Rousse. Par R. Letorey. *With Map and Illustrations.*

Alps. *J. Geology* **13** (1905): 1–19. **Penck.**

Glacial features in the surface of the Alps. By A. Penck.

Summarizes some of the conclusions reached in 'Die Alpen im Eiszeitalter.'

Alps. **Penck and Brückner.**

Die Alpen im Eiszeitalter. Von Dr. A. Penck und Dr. E. Brückner. Lieferung 7. Leipzig: C. H. Tauchnitz, 1905. Size 10½ × 7½, pp. 657–784. *Maps and Illustrations. Presented by the Publisher.*

Alps. **Coolidge, Duhamel, and Perrin.**

Conway and Coolidge's Climbers' Guides. The Central Alps of the Dauphiny. By W. A. B. Coolidge, H. Duhamel, and F. Perrin. Second edition. London: T. Fisher Unwin. 1905. Size 6½ × 4½, pp. xiv. and 220. *Price 7s. 6d. net. Presented by the Publisher.*

This edition has been carefully revised and the information brought up to the end of 1904. Consistently with its destination for climbers only, the sections on routes of approach, and on inns, etc., have been omitted.

Alps. **Whymper.**

The Valley of Zermatt and the Matterhorn. A Guide by Edward Whymper. 9th edition, pp. xxv. and 224. Chamonix and the Range of Mont Blanc. By the same. 10th edition. Size 7½ × 5, pp. xiv. and 206. *Maps and Illustrations. Two copies of each, presented by the Author and Publisher.*

Alps—Geology. *C. Rd.* **140** (1905): 1072–1073. **Sandberg.**

Sur l'âge du granite des Alpes occidentales et l'origine des blocs exotiques cristallins des Klippes. Note de C. G. S. Sandberg.

Alps—Simplon. *P.R.S.*, Ser. A., **76** (1905): 29–33. **Fox.**

The Boring of the Simplon Tunnel, and the Distribution of Temperature that was encountered. By F. Fox. *With Section.*

See note in the Monthly Record (August, p. 214).

Alps—Simplon. *La G., B.S.G. Paris* **11** (1905): 81–96. **Schardt.**

Les eaux souterraines du tunnel du Simplon. Par H. Schardt. *With Illustrations.*

Noticed in the June number (p. 672).

Alps—Simplon. *Globus* **87** (1905): 197–198. ——

Der Durchstich des Simplon. *With Sections.*

Austria. *G. Abh.* **8**, Heft 3 (1905): pp. 206. **Hassinger.**

Geomorphologische Studien aus dem inneralpinen Wiener Becken und seinem Randgebirge. Von Dr. H. Hassinger. *With Sections.*

Austria—Bosnia. *Abrégé B.S. Hongroise G.* **30** (1902): 70–82. **Thallóczy.**

Bosnien als historischer Schauplatz. Gestalt, Grenzen, geologische, hydrographische und geographische Verhältnisse. Tier- und Pflanzenwelt. (*Földrajzi Közlemények* **30** (1902): 210–238.)

Austria—Geodesy. ——

Die Ergebnisse der Triangulierungen des K. u. K. Militär-Geographischen Institutes. 3 vols. Wien, 1901–1905. Size 11 × 8, pp. (vol. 1) x. and 218; (vol. 2) viii. and 172; (vol. 3) viii. and 274. *Maps. Presented by the K. u. K. Militärgeographisches Institut.*

Austria—Herzegovina. *Petermanns M.* **51** (1905): 76–81. **Daneš and Thon.**

Die westhercegovinische Kryptodepression. Reisebericht von Dr. J. V. Daneš und Dr. K. Thon. *Also separate copy.*

Bulgaria. *Petermanns M.* **51** (1905): 69–70. **Ischirkoff.**

Die hypsometrischen Verhältnisse des Fürstentums Bulgarien. Von Prof. Dr. A. Ischirkoff.

Central Europe—Communications. *Petermanns M.* 51 (1905): 65–66. **Held.**
Die Verkehrsgürtel von Berlin und Wien. Von Prof. F. Held. ***With Maps.***
Shows the greater width of the isochronic zones for Berlin than for Vienna, largely owing to physical factors.

Central Europe—Communications. *G.Z.* 11 (1905): 85–99, 145–162. **Müller.**
Das spätmittelalterliche Strassen- und Transportwesen der Schweiz und Tirols. Eine geographische Parallele. Von Dr. J. Müller.

Central Europe—Jura. *Spelunca* 5 (No. 40) (1905): pp. 26. **Fournier.**
Recherches spéléologiques dans la chaine du Jura. Par E. Fournier. 6[e] Campagne 1903–1904. *With Plans and Illustrations.*

Central Europe—Jura. *La G., B.S.G. Paris* 11 (1905): 108–112. **Offner.**
La végétation des lacs du Jura d'après M. Ant. Magnin. Par Dr. J. Offner. *With Illustrations.*

Central Europe—Rivers. *M.G. Ges. München* 1 (1905): 309–310. **Ule.**
Der Wasserhaushalt in den Strömen Mitteleuropas. Von Prof. Dr. W. Ule.

Denmark—Historical. *Aarb. Nord. Oldk. Hist.* 19 (1904): 1–64. **Müller.**
Vei og Bygd i Sten- og Bronzealderen. Af S. Müller. ***With Maps and Illustrations.***
On traces of ancient roads and settlements.

Europe—Ethnology. *J. Anthrop. I.* 34 (1904): 181–206. **Deniker.**
Les six races composant la population actuelle de l'Europe. Par le Dr. J. Deniker. ***With Maps and Illustrations.***

Færoes. **Børgesen.**
Om Algevegetationen ved Færøernes Kyster. En plantegeografisk undersøgelse. Af F. Børgensen. København og Kristiania: Gyldendalske Boghandel, 1904. Size 10½ × 7, pp. 122. *Map and Plates. Presented by the Author.*

Færoes and Iceland. **Annandale.**
The Færoes and Iceland: Studies in Island Life. By N. Annandale. With an Appendix on the Celtic Pony by F. H. A. Marshall, D.SC. Oxford: Clarendon Press, 1905. Size 8 × 5½, pp. viii. and 238. *Illustrations. Price 4s. 6d. net. Presented by the Publishers.*
Interesting studies made during holiday visits to the islands. It is especially the life of the people that is referred to, but there is a chapter on the bird-cliffs of the Westman isles, and an appendix on the Celtic pony. The ravages of the Turkish pirates from Algeria in the seventeenth century form the subject of a special chapter.

France. **Beyle and Chaytor.**
'Mémoires d'un Touriste' by Stendhal (Henri Beyle). Edited by H. J. Chaytor. (Oxford Modern French Series.) Oxford: Clarendon Press, 1905. Size 7½ × 5, pp. xii. and 104. *Map and Illustrations. Price 2s. Presented by the Publishers.*
Another of the excellent series of French readers, in which Taine's 'Voyage aux Pyrénées' had previously appeared.

France. *B.S.G. Lille* 43 (1905): 274–301. **Merchier.**
L'Ardenne française, Meuse et Semoy. Par A. Merchier. *With Illustrations.*

France. *B.S.G. Rochefort* 27 (1905): 46–48. **Pawlowski.**
L'orcanie géologique et historique. Par A. Pawlowski.
Orcanie is the name for a submarine plateau near the Isle de Ré.

France—Alps. *La G., B.S.G. Paris* 11 (1905): 328–330. **Martel.**
L'oucane de Chabrières (Hautes-Alpes). Par M. E. A. Martel.

France—Causses. *B.S.G. Com. Bordeaux* 31 (1905): 41–54. **Buffault.**
Le Reboisement des Causses. Par P. Buffault.
While recognizing that the restoration of the old forests that once covered the Causses is impossible, the author thinks that a partial reforestation would be both feasible and beneficial.

France—Puy-de-Dôme. *La G., B.S.G. Paris* 11 (1905): 293–301. **Baldit.**
La sécheresse de l'été et de l'automne 1904 dans la région du Puy-de-Dôme. Par A. Baldit. *With Map.*

France—River-captures. *C. Rd.* 140 (1905): 745-748. **Fournier.**
Sur des phénomènes de capture de cours d'eau datant du XVII^e, du XVIII^e et du début du XIX^e siècle, prouvés par des documents cartographiques. Note de E. Fournier.

Noticed in the Monthly Record (August, p. 213).

France—Vienne. *Ann. G.* 14 (1905): 111-117. **Blayac and Vacher.**
La vallée de la Vienne et le coude d'Exideuil. Par J. Blayac et A. Vacher. *With Map.*

See note at p. 213, *ante.*

Germany—Coast-changes. *Petermanns M.* 51 (1905): 73-76. **Hansen.**
Küstenänderungen in Süderdithmarschen im 19. Jahrhundert. Von Prof. Dr. R. Hansen. *With Maps.*

Germany—Population. *Ann. G.* 14 (1905): 118-125. **Auerbach.**
La population de l'Empire Allemand d'après le recensement de 1900. Phénomènes démographiques et Industrie. Statistique confessionnelle et Linguistique. Par B. Auerbach.

Germany—Prussia—Statistics. **Blenck.**
Festschrift des Königlich Preussischen Statistischen Bureaus zur Jahrhundertfeier seines Bestehens. 3 vols. (1 and 2 in one vol.) Erster Teil: Das Königliche Statistische Bureau im ersten Jahrhundert seines Bestehens 1805 bis 1905. Herausgegeben von E. Blenck. Pp. xii. and 272. Zweiter Teil: Tabellen und Uebersichten zum Statistischen Atlas für den Preussischen Staat. Pp. viii. and 152. Dritter Teil: Statistischer Atlas für den Preussischen Staat. 8 pp. and 116 plates. Berlin, 1905. Size 13 × 9½. *Presented by the Bureau.*

A valuable and comprehensive summary of the statistics of the kingdom of Prussia in the form of tables, maps, and diagrams. It would have been instructive if geological and hypsometrical maps had been added, to facilitate correlation of the statistical data with physical factors.

Germany—Saxony. **Proot.**
Tijds. K. Ned. Aard. Genoots. Amsterdam 22 (1905): 476-494.
Het Elbe-Zandsteengebergte. Door Mej. J. M. Proot. *With Illustrations.*

Germany—Weser. *M.K.K.G. Ges. Wien* 48 (1905): 123-132. **Schucht.**
Das Mündungsgebiet der Weser zur Zeit der Antoniflut (1511). Von Dr. F. Schucht. *With Map.*

Noticed in the July number (p. 85).

Greece—Eubœa. *Ann. G.* 14 (1905): 126-143. **Deprat.**
Esquisse de la géographie physique de l'île d'Eubée dans ses relations avec la structure géologique. Par J. F. Deprat. *With Illustrations.*

Hungary—Emigration. *Abrégé B.S. Hongroise G.* 30 (1902): 17-45. **Thirring.**
Die Auswanderung aus Ungarn. Von Dr. G. Thirring. *Maps and Diagrams.*

See *Journal*, vol. 24, p. 586.

Hungary—Waterways. *Abrégé B.S. Hongroise G.* 30 (1902): 46-56. **Gerster.**
Die Wasserstrassen Ungarns. Von B. Gerster. (*Földrajzi Közlemények* 30 (1902): 253-264.)

Iceland. *Petermanns M.* 51 (1905): 49-53. **Thoroddsen.**
Die Bruchlinien Islands und ihre Beziehungen zu den Vulkanen. Von Prof. Dr. T. Thoroddsen. *With Maps.*

Iceland—Meteorology. *J. Scottish Meteorolog. S.* 13 (1905): 33-37. **Muir.**
Notes on the Weather on the Vatna Jökull during August and September, 1904. By T. S. Muir.

Iceland—Survey. *G. Tidskrift* 18 (1905-6): 1-14. **Koch.**
Fra Generalstabens topografiske Afdelings Virksomhed paa Island. Ved Premierløjtnant J. P. Koch. *With Map.*

Italy. *A travers le Monde* 11 (1905): 145-148. **Maumené.**
Les Villages pélasgiques des monts des Volsques. Par C. Maumené. *With Illustrations.*

Italy—Friuli. *B.S.G. Italiana* 6 (1905): 36–38. **Bertolini.**
Di una misura derivata dalla particolare condizione del suolo. Nota del Prof. G. L. Bertolini.

The measure spoken of is the "falce," used as a unit in specifying the right of cutting hay in the communal lands of Friuli

Italy—Sardinia. **Merlo.**
G. Merlo. L'Iglesiente propriamente detto e la sua costituzione geologica. (Estratto dalla *Rassegna Mineraria*, vol. 21, nn. 5, 6, e 7: 11 e 21 agosto e 1° settembre 1904.) Torino, 1904. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. 36. *Map. Presented by the Author.*

Italy—Silk. **Chapman.**
Silk Trade and yield of cocoons in Italy in 1904. Foreign Office, Miscellaneous, No. 632, 1905. Size $10 \times 6\frac{1}{2}$, pp. 10. *Price* 1*d.*

Norway. *La G., B.S.G. Paris* 11 (1905): 115–121. **Rabot.**
Exploration géologique du Jotunheim. Par C. Rabot. *With Illustrations.*

Norway. *La G., B.S.G. Paris* 11 (1905): 113–115. **Rabot.**
L'éboulement du Ravnefjeld. Par C. Rabot. *With Sketch-map.*

Norway—Cartography. *Petermanns M.* 51 (1905): 58–62. **Nissen.**
Die Kartographie Norwegens. Eine kurze Uebersicht. Von P. Nissen.

Pyrenees. **Taine and Robertson.**
Voyage aux Pyrénées, by H. Taine. Edited by W. Robertson. Oxford: Clarendon Press, 1905. Size $7\frac{1}{2} \times 5\frac{1}{2}$, pp. xvi. and 212. *Map. Price* 2*s.* 6*d. Presented by the Publishers.*

One of an excellent series of French reading-books designed with a view to the gaining a knowledge of French nineteenth-century literature. The introduction gives a sketch of Taine's life and of the circumstances in which the present work (the outcome of a commission to write a guide-book to the Pyrenees) came to be written.

Russia. *Deutsch. Rundschau G.* 27 (1905): 259–269, 308–319. **Olinda.**
Das heutige Livland. Von Dr. A. Olinda. *With Illustrations.*

Spain—Pyrenees. *B.R.S.G. Madrid* 47 (1905): 79–92. **Briet.**
El Paso de las Devotas en los Pirineos españoles. Por L. Briet. *With Illustrations.*

Spain—Valencia. *B.R.S.G. Madrid* 47 (1905): 93–157. **Soler y Pérez.**
Por el Júcar. Por E. Soler y Peréz. *With Map and Illustrations.*

A study of the geography of a district in the west of the province of Valencia.

Sweden. *Ymer* 25 (1905): 17–35. **Ahlenius.**
Bidrag till Siljansbäckenets geografi. Af K. Ahlenius. *With Maps and Illustrations.*

Sweden. *La G., B.S.G. Paris* 11 (1905): 359–367. **Rabot.**
La distribution de la population en Suède en fonction de la constitution géologique du sol. Par C. Rabot. *With Map and Illustrations.*

Based chiefly on papers in *Ymer* (cf. *Journal*, vol. 25, p. 453).

Sweden—Geological history. **Post.**
Sveriges Geolog. Undersök., Ser. C., No. 195 (1903): pp. 36.
En profil genom högsta Litorinavallen på södra Gotland. Af L. von Post. *With Map and Illustrations.*

Switzerland. **Baedeker.**
Switzerland and the adjacent portions of Italy, Savoy, and Tyrol. Handbook for Travellers by Karl Baedeker. 21st edition. Leipsic: K. Baedeker; London: Dulau & Co. 1905. Size $6\frac{1}{2} \times 4$, pp. xxxviii. and 548. *Maps, Plans, and Panoramas. Price* 8 *marks. Two copies, presented by the Editor and Publishers.*

Switzerland. *La G., B.S.G. Paris* 11 (1905): 212–216. **Bonaparte.**
L'influence de l'exposition sur le site des villages dans le Valais. Par Prince Roland Bonaparte. *With Illustrations.*

Switzerland. **Groll.**
Der Oeschinensee im Berner Oberland. Von Max Groll. Bern, 1904. Size $9 \times 6\frac{1}{2}$, pp. vi. and 78. *Maps and Illustrations. Presented by the Author.*

Switzerland. *M.G. Ges. München* 1 (1905): 303–305. **Kittler.**
Den Einfluss der Alpenpässe auf die Entsehung der Eidgenossenchaft. Von Dr. O. Kittler.

Switzerland—Geographical Dictionary. **Knapp, Borel, and Attinger.**
Geographisches Lexikon der Schweiz . . . herausgegeben unter der leitung von O. Knapp, M. Borel und V. Attinger. Deutsche Ausgabe besorgt von H. Brunner. Dritter Band. Krailigen-Plentsch. Neuenburg: Gebrüder Attinger, 1905. Size 11 × 7½, pp. viii. and 768. *Maps and Illustrations. Presented by Dr. H. Brunner.*

ASIA.

Caspian Sea. *Ymer* 25 (1905): 36–75. **Falk.**
Om utvecklingen af kännedomen om Kaspiska hafvet. Af A. Falk.

Central Asia—Tian Shan. *Sitzb. K.B.A.W. München* (1904): 277–369. **Merzbacher.**
Forschungsreise im Tian-Schan. Von G. Merzbacher.

Ceylon. **Dunstan.**
Ceylon. Reports on the Results of the Mineral Survey in 1903–4. By Prof. W. R. Dunstan, F.R.S., etc. Colonial Reports, Miscellaneous, No. 29. 1905. Size 10 × 6, pp. 34. *Price* 2½*d.*
Noticed in the Monthly Record (August, p. 215).

China. **Genschow.**
Unter Chinesen und Tibetanern. Von A. Genschow. Rostock i. M.; C. J. E. Volckmann, 1905. Size 10 × 6½, pp. vi. and 384. *Maps and Illustrations. Price* 6*s.*
See p. 323, *ante.*

China. *B. Économique (Indo-Chine)* 7 (1904): 1283–1294. **Liébert and Brenier.**
Les ports et escales du Delta cantonais. Par G. Liébert. Note complémentaire, par H. Brenier. *With Map.*

China. *J.G., Tōkyō G.S.* 16 (1904): 422–435, 482–490. **Yamada.**
Travel to Yunnan, Sz'-tchuen and Kweichau Provinces. By K. Yamada. [In Japanese.] *With Illustrations.*

China and Tibet. *La G., B.S.G. Paris* 11 (1905): 285–292. **Grillières.**
Voyage au Yun-nan et au Thibet oriental. Par G. Grillières.

Chinese Empire—Tibet. *Periodical Accounts Moravian Missions* 6 (1905): 5–23. **Davey.**
The Buddhism of Tibet—a sketch. By J. W. Davey. *With Illustrations.*

Eastern Asia. **Franke.**
Was lehrt uns die ostasiatische Geschichte der letzten fünfzig Jahre? Vortrag von Dr. O. Franke. (Abteilung Berlin-Charlottenburg der Deutschen Kolonial-Gesellschaft, Verhandlungen 1903–5. Band viii. Heft 4.) Berlin: D. Reimer, 1905. Size 9 × 6, pp. 91–114. *Price* 60 *pfg. Presented by the Publisher.*

India—Assam. *T. Liverpool G.S.* (1904): 40–41. **Hodson.**
The Assam Hills. By T. C. Hodson. *With Plan.*

India—Assam. *Records Geolog. Surv. India* 31 (1904): 179–204, 205–232. **Maclaren.**
The Geology of Upper Assam. By J. M. Maclaren.
The Auriferous Occurrences of Assam. By the same.

India—Burma. **Wehrli.**
Beitrag zur Ethnologie der Chingpaw (Kachin) von Ober-Burma. Von Dr. H. J. Wehrli. (Supplement zu Bd. xvi. von "Internationales Archiv für Ethnographie.") Leiden: E. J. Brill, 1904. Size 13 × 10, pp. xvi. and 84. *Map and Plates. Price* 9*s.* 6*d.*

India—Burma. ———
The Burma Route Book. Part ii. Routes in North-Eastern Burma. Compiled in the Intelligence Branch, Quartermaster-General's Department in India. 1903. Calcutta, 1905. Size 13½ × 8½, pp. iv. and 304. *Map. Presented by the Intelligence Branch, Simla.*

India—Himalayas. *Alpine J.* 22 (1905): 348–352. **Neve.**
Nun Kun revisited. By Dr. A. Neve. *With Illustrations.*
Dr. Neve's former paper was noticed in the *Journal* in 1903 (vol. 21, pp. 671).

India—Historical. *Z. Deutsch. Morgenländ. Ges.* 58 (1904): 787–796. **Smith.**
The Indian Kings named Silāditya, and the Kingdom of Mo-la-p'o. By V. A. Smith. *With Map.*

India—Historical. **Bowrey.**

A Geographical Account of the Countries round the Bay of Bengal. By Thomas Bowrey. Edited by Sir R. C. Temple. [Works issued by the Hakluyt Society. Second Series. No. xii.] Cambridge, 1905. Size 9 × 6, pp. lvi. and 388. *Facsimile Map and Illustrations. Presented by the Hakluyt Society.*

Printed from a hitherto unpublished manuscript, which fills up a gap in the early history of the doings of the English in the East. The author, who gave his initials only, has, after much research, been satisfactorily identified as Thomas Bowrey. The work is admirably edited, all points needing elucidation having been thoroughly threshed out.

India—Madras. **Marsden.**

A Geography of the Madras Presidency adapted to the requirements of the Primary Examination. By E. Marsden. 3rd edition. London: Macmillan & Co., [*not dated*]. Size 7 × 5, pp 80. *Maps and Illustrations.*

India—Minerals. *Records Geolog. Surv. India* 32 (1905): 1–118. **Holland.**

Review of the Mineral Production of India during the years 1898 to 1903. By T. H. Holland, F.R.S. *With Map and Diagrams.*

India—Shan States. *J.S. Arts.* 53 (1905): 623–641. **Scott.**

The Prospects of the Shan States. By Sir J. G. Scott, K.C.I.E. *With Map.*

Japan. *J.G., Tōkyō G.S.* 16 (1904): 668. **Fukuchi.**

Structure of the Volcanic Island Miyakejima. By N. Fukuchi. [In Japanese.]

Japan. *J.G., Tōkyō G.S.* 16 (1904): 764–772. **Tanaka.**

On Lake Numazawa. (Limnological Researches in Japan, No. 7.) By A. Tanaka. [In Japanese.]

Japan—Population. *Questions Dipl.* 19 (1905): 539–550. **Gounard.**

Les Japonais sont-ils à l'étroit au Japon? Étude sur les conditions démographiques de l'expansion Japonaise. Par Prof. R. Gounard.

Discusses the question whether the population of Japan has outgrown the resources of the country. The answer is in the negative.

Malay Archipelago—Timor. **Bakhuis.**

Tijds. K. Ned. Aard. Genoots., Amsterdam 22 (1905): 497–499.

Bij de kaart van een deel van het eiland Timor op de schaal 1 : 500,000. Door L. A. Bakhuis. *With Map.*

Pamirs. *J.G., Tōkyō G.S.* 16 (1904): 3–10, 87–104, 289–298, 349–354, 473–481. **Ōtani.**

Travel to Pamir. By K. Ōtani. [In Japanese.] *With Map.*

Philippine Islands. **Blair and Robertson.**

The Philippine Islands, 1493–1898. Edited . . . by E. H. Blair and J. A. Robertson, with historical introduction, etc. By E. G. Bourne. Vol. 21, 1624 (pp. 320); vol. 22, 1625–1629 (pp. 324); vol 23, 1629–1630 (pp. 298); vol. 24, 1630–1634 (pp. 340); vol. 25, 1635–1636 (pp. 322). Cleveland, Ohio: The Arthur H. Clark Co., 1905. Size 10 × 6¾. *Illustrations.*

Philippine Islands. *National G. Mag.* 16 (1905): 139–192. ———

A Revelation of the Filipinos. *With Illustrations.*

Philippine Islands—Census. ———

Census of the Philippine Islands, taken under the direction of the Philippine Commission in the year 1903. 4 vols. Vol. 1, Geography, History, and Population (pp. 620); vol. 2, Population (pp. 1048); vol. 3, Mortality, Defective Classes, Education, Families and Dwellings (pp. 740); vol. 4, Agriculture, Social and Industrial Statistics (pp. 638). Washington: United States Bureau of the Census, 1905. Size 9½ × 6. *Maps and Illustrations. Presented by the Bureau of the Census, Washington.*

Forms a nearly exhaustive statistical account of the Philippines, their inhabitants, productions, etc.

Russian Central Asia. **Lipsky.**

Upper Bukhara. Results of three years' travels in Central Asia in 1896, 1897, and 1899. V. I. Lipsky. Part iii. [In Russian.] St. Petersburg, 1905. Size 11½ × 9, pp. 547–735. *Map and Illustrations.*

Russian Central Asia. *G. Tidskrift* 18 (1905–6): 69–85. **Olufsen.**

Oasen Merv. Af Premierløjtnant O. Olufsen. *With Map and Illustrations.*

South-East Asia. **Little.**
Across Yunnan and Tonking. By Archibald Little. Shanghai, 1905. Size 9½ × 6, pp. 34. *Maps.*
Describes a journey made in 1904 from Chengtu to Hanoi and Haiphong.

Straits Settlements—Penang. **Steuart.**
Imp. and Asiatic Quarterly Rev. 19 (1905): 112–123.
The Foundation of Penang—Captain Light and the Nonyah. By A. F. Steuart.

Turkey—Palestine. **Libbey and Hoskins.**
The Jordan Valley and Petra. By W. Libbey, SC.D., and F. E. Hoskins, D.D. 2 vols. New York and London: G. Putnam's Sons, 1905. Size 9 × 6, pp. (vol. 1) xvi. and 354; (vol. 2) viii. and 380. *Map and Illustrations. Presented by Dr. W. Libbey.* [To be reviewed.]

Western Asia. **Le Strange.**
The Lands of the Eastern Caliphate: Mesopotamia, Persia, and Central Asia from the Moslem Conquest to the time of Timur. By G. Le Strange. Cambridge: University Press, 1905. Size 8 × 5½, pp. xviii. and 536. *Maps. Price* 15*s. Presented by the Publishers.* [To be reviewed.]

AFRICA.

Abyssinia. *Questions Dipl.* 19 (1905): 465–477. **Caix.**
La question d'Éthiopie. Par R. de Caix.

Abyssinia. *B.S.G. Italiana* 6 (1905): 19–30. **Castro and Oddone.**
Risultati delle osservazioni meteorologiche ad Addis-Abeba ed Addis-Alem nel bacino dell' Hauash in Abissinia, compiute dal dott. Lincoln de Castro, e compilate dal dott. E. Oddone. *With Illustrations.*

Abyssinia. *B.S.G. Italiana* 6 (1905): 8–18. **Felizzano.**
Nei Paesi Galla a sud dello Scioa. Relazione di viaggio del cap. Conte G. Colli di Felizzano.

Africa—Railways. *Deutsch. Rundschau G.* 27 (1905): 299–308. **Wagner.**
Tropische Eisenbahnen. Zeitgemässe Betrachtungen von R. Wagner. *With Map and Illustrations.*

Basutoland. ———
Basutoland. Report for 1903–4, with Returns of the Census, 1904. Colonial Reports, Annual No. 444, 1905. Size 9½ × 6, pp. 64. *Price* 3*d.*

British East Africa. *J. Anthrop. I.* 34 (1904): 255–265. **Tate.**
Further notes on the Kikuyu tribe of British East Africa. By H. R. Tate. *With Illustrations.*

British East Africa. ———
Africa. No. 4 (1905). Reports from the Director of Agriculture on the Government Farms at Nairobi and Naivasha in the East Africa Protectorate for the year 1904, and on the Prospects of Settlers. London: Wyman & Sons, 1905. Size 13½ × 8½, pp. 50. *Illustrations. Price* 1*s.* 1*d.*
Noticed in the Monthly Record (August, p. 217).

Cape Colony—Census. ———
Results of a Census of the Colony of the Cape of Good Hope, as on the Night of Sunday, April 17, 1904. Cape Town, 1905. Size 13½ × 8½, pp. ccxviii. and 556. *Maps and Diagram. Presented by the Director of the Census.*
The general results of the census were noted in the *Journal* for December, 1904 (p. 679).

Central Africa. *B.S.R. Belge G.* 28 (1904): 461–482. **Flamme.**
Ethnographie congolaise. Région du lac Albert (N.-O.) et du Haut-Nil. Par Sous-lieutenant Flamme. *With Map and Illustrations.*

Central Africa—Zoology. *P. Zoolog. S.* 1904 (2) (1905): 193–199. **Thomas.**
On *Hylochœrus*, the Forest Pig of Central Africa. By O. Thomas. *With Plates.*

Congo State. **Pourbaix.**
Federation for the Defence of Belgian Interests Abroad. The Congo Free State and African Civilization. V. Pourbaix. Novembre 1904. Size 9½ × 6½, pp. 32. *Illustrations.*

East Africa. *Scottish G. Mag.* 21 (1905): 260–263. **Capenny.**
The Proposed Anglo-Abyssinian Boundary in East Africa. By S. H. F. Capenny. *With Map.*

Egypt—Irrigation. *La G., B.S.G. Paris* 11 (1905): 161–184. **Brunhes.**
L'irrigation en Égypte depuis l'achèvement du réservoir d'Assouan (1902). Par Prof. J. Brunhes. *With Map and Illustrations.*

Egypt—Meteorology. ———
The Meteorological Report for the year 1902. The Survey Department, Public Works Ministry, Cairo. Cairo, 1904. Size 7½ × 11, pp. 204. *Diagrams.*

Egypt—Suez Canal. *Abh. K.K.G. Ges. Wien* 5 (1903–4): No. 3, pp. 76. **Voss**
Der Suezkanal und seine Stellung im Weltverkehr. Von M. Voss.

Egyptian Sudan. *Blackwood's Mag.* 177 (1905): 544–554. **Balfour.**
The Waterways of the Sudan. From the Atbara to Tuti. By Dr. A. Balfour.
Sketches of life on the Nile and its tributaries.

Egyptian Sudan. *A travers le Monde* 11 (1905): 109–110. ———
Débouchés du Soudan égyptien. La Ligne de Berber-Souakim et le Port de Cheik-el-Barghoud. *With Map.*

French Congo. *La G., B.S.G. Paris* 11 (1905): 243–244. **Vaille.**
Voyage de M. Vaille dans l'Ivindo-n'Djadié. *With Map.*
See note in the July number (p. 87).

German East Africa. *Deutsch. Kolonialblatt* 16 (1905): 207–209. ———
Beobachtungen aus Deutsch-Mpororo.

Ivory Coast. *Tour du Monde* 11 (1905): 61–96. **Lamy.**
Souvenirs de la Côte d'Ivoire. Par le Docteur Lamy. *With Map and Illustrations.*

Madagascar. ———
Guide-Annuaire de Madagascar et Dépendances. Année 1905. Tananarive 1905. Size 9 × 6, pp. viii. and 800. *Maps.*

Madagascar—Surveys. *C. Rd.* 140 (1905): 1219–1222. **Colin.**
Travaux géodésiques et magnatiques aux environs de Tananarive. Note du R. P. Colin.

Morocco. *Petermanns M.* 51 (1905): 90–91. **Fischer.**
Der Djebel Hadid im südwestlichen Atlasvorland von Marokko. Von Prof. Dr. T. Fischer.

Morocco. *Rev. Française* 30 (1905): 223–236. **Segonzac.**
Maroc: La mission de Segonzac arrêtée. *With Map.*
Fuller details are given in the map accompanying M. Terrier's paper (see below).

Morocco. *Questions Dipl.* 19 (1905): 385–391. **Terrier.**
Dans le Bled Siba. La mission Segonzac. Par A. Terrier. *With Map.*
Account of exploration in the Atlas and region to the south (cf. *Journal*, vol. 25, p. 564, and *ante*, p. 338).

Morocco. **Gamazo.**
La Cuestión de Marruecos desde el punto de vista español por G. M. Gamazo. Madrid: M. Romero, 1905. Size 9 × 6, pp. viii. and 308. *Presented by the Publisher.*

Morocco. **Hübner.**
Militärische und militärgeographische Betrachtungen über Marokko. Ein Beitrag zu aktuellen Fragen. Von Max Hübner. Berlin: D. Reimer, 1905. Size 8 × 5½, pp. iv. and 100. *Maps. Price 2 marks. Presented by the Publisher.*
An account of the present position of the sultan's army, with a description of the country from a strategic point of view, and a discussion of the possibility of a military reorganization in the interests of the development of the country by European nations. The writer lays stress on the need of the opening of railway and other routes.

Nile Basin. **Lyons.**
The Rains of the Nile Basin in 1904. By Captain H. G. Lyons. Cairo, 1905 Size 11 × 7½, pp. 26. *Map and Diagrams*

North-East Africa. *P.R.S.*, Ser. A., 76 (1905): 66–86. **Lyons.**
On the relation between variations of atmospheric pressure in North-East Africa and the Nile Flood. By Captain H. G. Lyons. *With Diagram. Also separate copy, presented by the Author.*

Rhodesia. *Scottish G. Mag* 21 (1905): 137–152. **Heatley.**
The Development of Rhodesia and its Railway System in relation to Oceanic Highways. By J. T. P. Heatley. *With Maps and Illustrations.*

Rhodesia. *J. African S.* 3 (1903–4): 247–256; 4 (1905): 337–345. **Melland.**
Some ethnographical notes on the Awemba tribe of North-Eastern Rhodesia (and on some portion of the Wabisa). By F. H. Melland. *With Illustrations.*

Sahara—Figig. *Ann. G.* 14 (1905): 144–166. **Gautier.**
Rapport sur une mission géologique et géographique dans la région de Figuig. Par E. F. Gautier. *With Map and Sections.*

Sahara—Geology. *C. Rd.* 140 (1905): 1200–1201. **Foureau and Genti.**
Les régions volcaniques traversées par la Mission Saharienne. Note de F Foureau et L. Gentil.
See note in the Monthly Record (August, p. 218).

Sahara—Geology. *C. Rd.* 140 (1905): 957–959. **Haug.**
Sur la présence du Carbonifère moyen et supérieur dans le Sahara. Note de E. Haug.

South Africa—Ethnology. **Stow and Theal.**
The Native Races of South Africa. A History of the Intrusion of the Hottentots and Bantu into the Hunting Grounds of the Bushmen, the Aborigines of the Country. By George W. Stow. Edited by Dr. G. M. Theal. London: Sonnenschein & Co., 1905. Size 10 × 6, pp. xvi. and 618. *Map and Plates. Price 21s. net. Presented by the Publisher.* [To be reviewed.]

NORTH AMERICA.

Alaska. *Ann. Rep. Dep. Interior*, 1903, *Mis. Rep.*, Pt. II.: 1–102. **Brady.**
Report of the Governor of Alaska. *With Maps.*

Alaska *National G. Mag.* 16 (1905): 104–111. **Paige.**
A growing Camp in the Tanana Gold Fields, Alaska. By S. Paige. *With Illustrations.*

America—Maps. **Winsor.**
Library of Congress. The Kohl Collection (now in the Library of Congress) of Maps relating to America. By Justin Winsor. A Reprint of Bibliographical Contribution Number 19 of the Library of Harvard University. With Index by P. L. Phillips. Washington, 1904. Size 10½ × 7½, pp. 190.

Bermuda. *P. American A. Arts and Sci.* 40 (1905): 559–592. **Bigelow.**
Contributions from the Bermuda Biological Station for Research. No. 5, The Shoal-water Deposits of the Bermuda Banks. By H. B. Bigelow. *With Maps.*

Canada—Bay of Fundy. **Dawson.**
The currents at the entrance of the Bay of Fundy and on the steamship routes in its approaches off Southern Nova Scotia. From Investigations of the Tidal and Current Survey in the season of 1904. Published by the Department of Marine and Fisheries, Ottawa, Canada. Ottawa, 1905. Size 9½ × 6½, pp. 18. *Chart.*

Canada—Bibliography. **Wrong and Langton.**
Review of Historical Publications relating to Canada. Edited by G. M. Wrong and H. H. Langton. Vol. ix. Publications of the year 1904. Toronto: Morang & Co., 1905. Size 11 × 7½, pp. xii. and 240.

Canada—British Columbia. ——
Annual Report of the Minister of Mines for the year ending December 31, 1904, being an account of Mining Operations for Gold, Coal, etc., in the Province of British Columbia. Victoria, B.C, 1905. Size 10½ × 7½, pp. 318. *Map and Illustrations. Presented by the Department of Mines, Victoria, B.C.*
See note at p. 221, August number.

Canada—Place-names. ——
Fifth Report of the Geographic Board of Canada, containing all decisions to June

30, 1904. (Supplement to the Thirty-seventh Annual Report of the Department of Marine and Fisheries.) Ottawa, 1905. Size 10 × 6½, pp. 78.

Niagara. *Popular Sci. Monthly* 66 (1905): 489–504. **Clarke.**

The Menace to Niagara. By Dr. J. M. Clarke. *With Illustrations.*

Insists on the reality of the menace to Niagara from the operations of water-power companies, both American and Canadian.

North America—Geology. *J. Geology* 13 (1905): 89–104. ——

Report of the Special Committee for the Lake Superior region. With Introductory Note by C. R. Van Hise.

This committee was appointed to investigate the nomenclature and correlation of the geological formations of the U.S. and Canada.

United States. ——

Annual Reports of the Department of the Interior for the Fiscal Year ended June 30, 1902. Report of the Commissioner of Education. 2 vols. Pp. cxii. and 2448. Ditto June 30, 1903. Report of the Secretary of the Interior. Report of the Commissioner of the General Land Office. Pp. x. and 764. Indian Affairs, 2 parts, pp. (part i.) xii. and 628: (part ii.) 880. Miscellaneous Reports, 3 parts, pp. (part i.) 860; (part ii.) 958; (part iii.) viii. and 674. Size 9½ × 6. Also Twenty-fourth Annual Report of the United States Geological Survey. Pp. 302. Size 12½ × 8. Washington, 1903–4. *Maps and Illustrations. Presented by the U.S. Department of the Interior.*

United States—California—Santa Barbara Islands. **Eisen.**

An Account of the Indians of the Santa Barbara Islands in California. By Dr. G. Eisen. (Separatabdruck aus den Sitzungsberichten der K. Böhm. Gesellschaft der Wissenschaften, Prag, 1904.) Prag, 1904. London: A. Owen & Co. Size 10 × 6½, pp. 30. *Price 1s. net. Presented by the Publishers.*

Noticed in the Monthly Record (August, p. 220).

United States—Census. **Gannett.**

Twelfth Census of the United States, taken in the year 1900. Statistical Atlas. Prepared under the supervision of Henry Gannett. Washington: United States Census Office, 1903. Size 12 × 9½, pp. 58, 207 plates.

Gives the generalized results of the census in graphic form, with introductory letterpress.

United States—Census. ——

Bureau of the Census. Abstract of the Twelfth Census of the United States, 1900. Third edition. Washington, 1904. Size 9½ × 6, pp. xvi. and 454.

United States—Coal. **Bell.**

Coal Industry of the United States, 1903. Foreign Office, Miscellaneous, No. 631. 1905. Size 10 × 6½, pp. 36. *Price 2½d.*

See note at p. 88, *ante*.

United States—Historical. **Parkman.**

The California and Oregon Trail, being Sketches of Prairie and Rocky Mountain Life. By Francis Parkman. London: Dean & Son, [1905]. Size 7½ × 5, pp. xx. and 416. *Portrait. Price 2s. 6d. net. Presented by the Publishers.*

An acceptable reprint, at a popular price, of the work in which the well-known American historian gives his vivid personal impressions of travel and native life in the Far West. An introduction by Prof. E. G. Bourne supplies a sketch of Parkman's life and writings.

CENTRAL AND SOUTH AMERICA.

Argentine Republic. **Graziani.**

Dott. G. Graziani. La Emigrazione Italiana nella Repubblica Argentina. Torino, &c.: G. B. Paravia e Comp., 1905. Size 9 × 6½, pp. x. and 192. *Map. Presented by the Author.*

Of the million and a half emigrants into the Argentine from 1876 to 1899, 937,647 were Italians, and of these 651,337 were agriculturists.

Argentine Republic. **Boman.**

Migrations Précolombiennes dans le nord-ouest de l'Argentine. Communication faite à la Société des Américanistes de Paris, dans sa Séance du 6 décembre 1904. Par É. Boman. (Extrait du *Journal de la Société des Américanistes de Paris*, N.S., tome ii., No. 1, pp. 91–108.) 1905. Size 11 × 7½. *Illustrations. Presented by the Author.*

Argentine Republic. *Minutes of P.I. Civil Engineers* 159 (1905): 290–294. **Rowbotham.**
Mines and Mining in the Argentine Republic. By J. McK. Rowbotham.

Atacama Desert. *B.I.G. Argentino* 21 (*n.d.*): 87–116. **Ambrosetti.**
Viaje á la Puna de Atacama. De Salta a Caurchari. Por J. B. Ambrosetti. *With Illustrations.*

Bahamas. **Allen and Barbour.**
Narrative of a Trip to the Bahamas. By G. M. Allen and T. Barbour. Cambridge, Mass., 1904. Size 10 × 6½, pp. 10. *Map and Illustrations. Presented by the Authors.*

The trip was chiefly for the study of the flora and fauna.

Bolivia. *B. Oficina Nac. Inmigración La Paz* 4 (1904): 484–530. **Bandelier.**
Mitos y Tradiciones aborigenes concernientes á la Isla de Titicaca, Bolivia. Por A. F. Bandelier.

Bolivia. *B. Oficina Nac. Inmigración La Paz* 4 (1904): 454–483. **Varnoux.**
Determinación de las co-ordenadas geográficas del punto de intersección del paralelo 22° A, con il rio Pilcomayo. L. Varnoux.

Bolivia and Peru. *Scottish G. Mag.* 21 (1905): 249–259. **Hill.**
Notes on a Journey in Bolivia and Peru around Lake Titicaca. By A. W. Hill. *With Illustrations.*

See short report of paper by Mr. Hill at the British Association last year (*Journal*, vol. 24, p. 461).

Brazil. *B. Geolog. S. America* 13 (1902): 41–98. **Branner.**
Geology of the North-East Coast of Brazil. By J. C. Branner. *With Maps and Illustrations.*

Brazil. *B.S.G. Lima* 15 (1904): 87–93. **Herrera.**
Clima de la Amazonia. Por el Dr. G. E. Herrera.

Brazil. *Globus* 87 (1905): 281–283. **Koch.**
Dr. Theodor Kochs Forschungsreise in Brasilien.

See note in the July number (p. 89).

Brazil. *Globus* 87 (1905): 341–347. **Koenigswald.**
Die indianischen Muschelberge in Südbrasilien. Von G. von Koenigswald. *With Illustrations.*

Will be noticed in the Monthly Record.

Brazil and Argentine Republic. *Globus* 87 (1905): 216–221. **Vogt.**
Die Victoriafälle des Iguazú. Von F. Vogt. *With Map and Illustrations.*

British Guiana and Brazil—Boundary. ———
British Guiana Boundary Arbitration with the United States of Brazil. The Case on Behalf of the Government of His Britannic Majesty (pp. 162); The Counter Case (pp. 190); Notes to the Counter Case (pp. 104); The Argument (pp. iv. and 178); Index to Sir Robert Schomburgk's Reports, which form volume 3 of Annex to British Case (pp. 86); Extracts from, and Notes on, some of the Printed Books examined in connection with the British Guiana—Brazil Boundary Arbitration (pp. v. and 156).
Boundary. British Guiana—Brazil. Translations of Additional Portuguese Documents (pp. 72).
Question de la Frontière entre la Guyane Britannique et le Brésil. Mémoire présenté par le Gouvernement de sa Majesté Britannique (pp. 176);-Annexe—vol. 1, 1596-1822 (pp. xvi. and 224); vol. 2, 1827-1902 (pp. xii. 150, vi. 44, 26, and 6); vol. 3, 1835-1843 (pp. 192); vol. 4 (pp. vi. and 34); Contre-Mémoire (pp. iv. and 202); Notes Adjointes au Contre-Mémoire (pp. 106); Annexe au Contre-Mémoire—vol. 1 (pp. 66), vol. 2 (pp. vi. and 56); Argument (pp. iv. and 184). London, 1903–4. Size 13 × 8½. *Maps.*
Atlas. 2 vols. Size 29½ × 22½. *Presented by the Foreign Office.*

Chile and Argentina. **Patron.**
República de Chile. Oficina de Límites. La Cordillera de los Andes entre las latitudes 46° i 50° S. Luis Riso Patron S. Santiago de Chile, 1905. Size 11 × 8, pp. x. and 234. *Maps and Illustrations.*

A continuation of the collection of documents illustrating the investigation of the Chili-Argentine Boundary.

Cuba. *B.S.G. Lyon* **20** (1905): 55–66. **Berchon.**
Renseignements Économiques et Géographiques sur l'Ile de Cuba. Par C. Bernhon. *With Map.*

Ecuador. *C. Rd.* 140 (1905): 998–1006. **Poincaré.**
Rapport présenté au nom de la Commission chargée du contrôle scientifique des opérations géodésiques de l'Équateur. Par H. Poincaré.
See note in the Monthly Record (August, p. 221).

French Guiana. *La G., B.S.G. Paris* 11 (1904): 191–204. **Deydier.**
Trois ans à la Guyane française (1901–1905). Par J. Deydier. *With Illustration.*

Martinique. *Ann. G.* 14 (1905): 97–110. **Lapparent**
La Montagne Pelée et ses éruptions. Par A. de Lapparent.

Martinique—Mont Pelée. **Lacroix.**
La Montagne Pelée et ses éruptions. Par A. Lacroix. Paris: Masson et Cie., 1904. Size 13 × 10, pp. xxii. and 662. *Plates and Illustrations. Presented by the Académie des Sciences, Paris.* [To be reviewed.]

Paraná. **Seljan.**
Mirko y Stevo Seljan. El salto del Guayrá. La Chute du Guayrá. Buenos Aires, 1905. Size 10½ × 7½, pp. iv. and 44. *Map and Illustrations. Presented by the Authors.*

The authors made a careful survey of the Guayra falls during a scientific mission to that region. They make the somewhat bold statement that these falls stand at the head of all the waterfalls in the world for the volume of water precipitated, relying solely on the great volume of the Parana at its mouth, after it has received all its tributaries.

Peru. *B.S.G. Lima* **13** (1903): 121–159, 249–295, 385–418; **15** (1904): 1–57. **Brüning.**
De Chiclayo á puerto Meléndez en el Marañón. Por E. Brüning. *With Maps and Illustrations.*

Peru. *B.S.G. Lima* **15** (1904): 60–65. **Espinar.**
El rio Igara-Paraná. Por el capitán F. E. Espinar. *With Map.*
There is a northern tributary of the Putumayo, on which a Peruvian station has been established, though the territory has been shown as Columbian on many maps.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Calvert Expedition. **Hill.**
The Calvert Scientific Exploring Expedition. (Australia, 1896.) Compiled by J. G. Hill. London: G. Philip & Son, 1905. Size 9½ × 7, pp. viii. and 44. *Maps Price 2s. Two copies, presented by the Author and Publishers.*
Compiled from telegraphic news and Australian newspaper accounts.

Caroline Islands. *Petermanns M.* **51** (1905): 52–57. **Senfft.**
Die Karolineninseln Oleai und Lamutrik. Von A. Senfft. *With Map and Illustrations.*

Marianne Islands—Guam. **Safford.**
The useful plants of the Island of Guam, with an introductory account of the physical features and natural history of the island, of the character and history of its people, and of their agriculture. By W. E. Safford. (Smithsonian Institution, U.S. National Museum. Contributions from the *U.S. National Herbarium*, vol. 9.) Washington, 1905. Size 10 × 6, pp. 416. *Map and Illustrations. Presented by the U.S. National Museum.*

New Guinea. **Niermeyer.**
Tijds. K. Ned. Aard. Genoots. Amsterdam **22** (1905): 499–502.
A. B. Meyer's doorkruising van Nieuw-Guinea op zijn smalst. Door J. F. Niermeyer.

New Zealand. *Queensland G.J.* **19** (1903–4): 37–44. **Woolnough.**
New Zealand: its Geographical and Meteorological Conditions considered in their bearing on Field Industries. By G. Woolnough.

New Zealand—Statistics. ———
Statistics of the Colony of New Zealand, 1903. 2 vols. Wellington, 1904. Size 13 × 8, pp. 618 and xvi.

Queensland. *Queensland G.J.* 19 (1903-4): 32-36. **Douglas.**
Maritime Boundary of Queensland. By the Hon. J. Douglas, C.M.G.

Queensland. *Minutes of the P.I. Civil Engineers* 159 (1905): 315-323. **Williams.**
The Artesian System of Western Queensland. By C. J. R. Williams. *With Diagrams.*

South Australia—Northern Territory. **Searcy.**
In Northern Seas. Being Mr. Alfred Searcy's Experiences on the North Coast of Australia, as recounted to E. Whitington. Reprinted from the *Register* (South Australia). Adelaide, 1905. Size 10 × 6½, pp. 64. *Map and Illustrations.*

Reminiscences dating from twenty-five years ago and onwards, printed with a view to attracting attention to the advantages of the Northern Territory.

POLAR REGIONS.

Antarctic. **Arçtowski.**
Antarctic Meteorology and International Co-operation in Polar Work. By Henryk Arçtowski. (Paper read at the Eighth International Geographical Congress, New York, 1904.) Size 9½ × 6, pp. 6. *Presented by the Author.*

Arctic. **Spencer.**
Dr. Nansen's "Bathymetrical Features of the North Polar Sea, with a discussion of the Continental Shelves and the Previous Oscillations of the Shore-line." Reviewed by J. W. Spencer. (From the *American Geologist*, vol. 25, April, 1905.) Size 9½ × 6, pp. 221-235. *Presented by the Author.*

Arctic—Ice. **Garde.**
The state of the Ice in the Arctic Seas, 1904. Prepared by V. Garde. (Special print of the Nautical-Meteorological Annual of the Danish Meteorological Institute.) Size 12½ × 9½, pp. xvi. *Maps.*

The conclusion is reached that the winter of 1903-4 was comparatively mild in the region north of the Atlantic, and that the ice brought down during the year by the East Greenland current was below the normal; the Labrador current, on the other hand, carried more icebergs than in a normal year, though less than in 1903.

Arctic—Sverdrup Expedition. **Nathorst.**
Report of the Second Norwegian Arctic Expedition in the *Fram*, 1898-1902. No. 1. A. G. Nathorst: Die oberdevonische Flora des Ellesmere-Landes. Published by Videnskabs-Selskabet i Kristiania: Kristiania. Printed by A. W Brøgger, 1904. Size 11 × 7½, pp. 22. *Map and Illustrations.*

Greenland. *G. Tidskrift* 18 (1905-6): 46-69. **Bruun.**
Om Vestgrønlænderne. Af Kaptajn D. Bruun. *With Illustrations.*

Greenland. *Petermanns M.* 51 (1905): 90. **Engell.**
Eine nachtertiäre Wärmeperiode in Grönland. Von Dr. M. C. Engell. *With Map.*

MATHEMATICAL GEOGRAPHY.

Astronomy. **Heath.**
Our Stellar Universe: Six Stereograms of Sun and Stars. By T. E. Heath. London: King, Sell & Olding, [1905]. Size 8½ × 4½. *Price 3s. net. Presented.*

Describes drawings for use with the stereograph, embracing those stars of which the parallax has been determined.

Cartography. *Abh. K.K.G. Ges. Wien* 5 (1903-4), No. 4: pp. 36. **Schjerning.**
Ueber mittabstandstreue Karten. Von Dr. W. Schjerning. *With Maps.*

Discusses the mathematical principles involved and method of constructing the degree-net, in the case of a projection (whether normal, transverse, or diagonal), which shall give all distances, measured in a straight line from the centre of the map, their true proportion. By sacrificing accuracy of azimuth, the projection may be modified so as to lessen the exaggeration which otherwise occurs at a distance from the centre in a tangential direction.

Compass. *M.G. Ges. München* 1 (1905): 161-260. **Wolkenhauer.**
Beiträge zur Geschichte der Kartographie und Nautik des 15. bis 17. Jahrhunderts. Von Dr. A. Wolkenhauer. *With Maps and Illustrations.*

Deals with the gradual acquisition of knowledge respecting the variation of the compass and other of its properties.

Instrument. *Sci. P.R. Dublin S.* 10 (1904): 146–148. **Grubb.**
A new form of Position-finder for adaptation to Ships' Compasses. By Sir H. Grubb, F.R.S. *With Illustrations.*

Instrument. *M.G. Ges. München* 1 (1905): 269–283. **Schück.**
Das Horometer, ein älteres Instrument der mathematischen Geographie. Von A. Schück. *With Illustrations.*

The horometer was an instrument for determining the time at any position on the Earth's surface.

Instruments. **Gurley.**
A Manual of the Principal Instruments used in American Engineering and Surveying. Manufactured by W. & L. E. Gurley, Troy, N.Y. 37th Edition. Troy, N.Y.: W. & L. E. Gurley, 1904. Size 7 × 4½, pp. 446. *Illustrations. Price* 50 *cents. Presented by the Publishers.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Botanical Geography. *B.S. Languedoc. G.* 28 (1905): 5–14. **Blanc and Hardy.**
La cartographie botanique détaillée sur les environs de Montpellier pris comme exemple. Par L. Blanc et M. Hardy. *With Map.*

Climate. *Tijds. K. Ned. Aard. Genoots. Amsterdam* 22 (1905): 441–474. **Easton.**
De zon en het klimaat. Door Dr. C. Easton. *With Diagrams.*

Erosion Forms. *Sitzb. K.B.A.W. München* (1904): 397–420. **Günther.**
Erdpyramiden und Büsserschnee als gleichartige Erosionsgebilde. Von S. Günther. *With Illustrations.*

See note in the July number (p. 91).

Geological History. *G.Z.* 11 (1905): 65–85, 134–145. **Frech.**
Die wichtigsten Ergebnisse der Erdgeschichte. Von F. Frech. *With Illustrations.*

Geomorphology. *American J. Sci.* 19 (1905): 265–273. **Davis.**
The Bearing of Physiography upon Suess' Theories. By W. M. Davis.

Examines Suess' views in the light of the author's studies in the Tian Shan, etc.

Geomorphology—Cirques. *B. American G.S.* 37 (1905): 86–91. **Brown.**
Cirques: A Review. By R. M. Brown.

A useful summary of the varying views which have been held as to the origin of cirques.

Geomorphology—Mounds. *Science* 21 (1905): 514–516. **Branner.**
Natural Mounds or "Hog-wallows." By Prof. J. C. Branner.

Noticed at p. 219, *ante.*

Geophysics. *Nature* 72 (1905): 30–31. **See.**
Current Theories of the Consolidation of the Earth. By Dr. T. J. J. See.

Glaciers. **Chamberlin.**
A Contribution to the Theory of Glacial Motion. By T. C. Chamberlin. (The University of Chicago. The Decennial Publs. Printed from vol. 9.) Chicago, 1904. Size 11½ × 9, pp. 16. *Plates.*

Noticed in the Monthly Record for May (p. 571).

Ice—Nieve penitente. *Globus* 87 (1905): 261–262. **Deecke.**
Lässt sich der "Busserschnee" als vereiste Schneewehen auffassen? Von W. Deecke.

See note in the July number (p. 91).

Ice Age. **Howorth.**
Ice or Water? Another Appeal to Induction from the Scholastic Methods of Modern Geology. By Sir Henry H. Howorth. In 3 vols. Vols. 1 and 2. London: Longmans & Co., 1905. Size 9 × 6, pp. (vol. 1) lvi. and 536, and (vol. 2) viii. and 498. *Price* (2 vols.) 32*s. net. Presented by the Author.* [To be reviewed.]

Ice-erosion. *J. Geology* 13 (1905): 160–173. **Tarr.**
Some instances of moderate glacial erosion. By R. S. Tarr. *With Illustrations.*

Lagoons and Tides. **Marchi.**
Luigi de Marchi. La morfologia lagunare e il regime stazionario di marea. (Atti R. I. Veneto, t. lxiv. pᵉ iiᵃ.) Venezia, 1905. Size 9½ × 6½, pp. 683–714. *Map. Presented by the Author.*

Limnology. *G. Tidskrift* **18** (1905–6): 15–26. **Wesenberg-Lund.**
Om Naturforholdene i skotske og danske Søer. En Sammenlignende Studie. Af Dr. C. Wesenberg-Lund. *With Illustrations.*

Mountain Structure. *J. Geology* **13** (1905): 105–125. **Daly.**
The Accordance of Summit Levels among Alpine Mountains: the fact and its significance. By R. A. Daly. *Also separate copy, presented by the Author.*
To be noticed in the Monthly Record.

Meteorites. **Fletcher.**
British Museum (Natural History). Mineral Department. An Introduction to the Study of Meteorites, with a list of the Meteorites represented in the collection on January 1, 1904. By L. Fletcher. 1904. Size 8½ × 5½, pp. 110. *Plan. Presented by the British Museum.*

Meteorology. *Globus* **87** (1905): 317–323. **Krebs.**
Das meteorologische Jahr 1903–1904 und die Hochwasserfrage. Von W. Krebs. *With Diagrams.*

Meteorology. *Nature* **72** (1905): 111–112. **Lockyer.**
Islands for Weather Forecasting Purposes. By Dr. W. J. S. Lockyer. *With Diagrams.*

Oceanography. *B. Musée Océanograph. Monaco*, No. **31** (1905): pp. 12. **Chevallier.**
Relation entre la densité et la salinité des eaux de mer. Par M. Chevallier. *With Diagram.*

Oceanography. **Herwig.**
Die beteiligung Deutschlands an der Internationalen Meeresforschung. I. und II. Jahresbericht erstattet von dem Vorsitzenden der Wissenschaftlichen Kommission Dr. W. Herwig. Berlin: O. Salle, 1905. Size 11½ × 8, pp. 112. *Maps and Illustrations. Presented by the Commission.*

Oceanography. *Petermanns M.* **51** (1905): 1–4, 25–31, 62–63. **Nansen.**
Die Ursachen der Meeresströmungen. Von Prof. Dr. F. Nansen.
Noticed in the Monthly Record (*ante*, p. 336).

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. *Deutsch. Rundschau G.* **27** (1905): 289–299. **Kirchhoff.**
Ueber tellurische Auslese. Von Prof. Dr. A. Kirchhoff.

Discusses the question of adaptation to environment by natural selection. The great chest-capacity of dwellers at high elevations is among the instances cited.

Anthropogeography—Cities. *Contemporary Rev.* **87** (1905): 413–426. **Geddes.**
Civic Education and City Development. By Prof. P. Geddes.

Anthropology—Pygmies. *Globus* **87** (1905): 309–312, 325–329. **Schmidt.**
Prähistorische Pygmäen. Von E. Schmidt.

Commerce. *Rev. Gen. Marina* **56** (1905): 145–177. **Bichon.**
La evolución del comercio del mundo y sus relaciones con los descubrimientos cientificos del siglo XIX. Por M. Bichon.

Commercial—Treaties. **[Hertslet.]**
A Complete Collection of the Treaties and Conventions and Reciprocal regulations at present subsisting between Great Britain and Foreign Powers; and of the Laws, Decrees, Orders in Council, etc., concerning the same; so far as they relate to Commerce and Navigation, the Slave Trade, Post Office Communications, Copyright, etc. [In continuation of the Collection compiled by Sir Edward Hertslet, K.C.B.] Vol. 20. Compiled and Edited by A. H. Oakes and H. F. T. Streatfield; vol. 21, by A. H. Oakes and R. W. Brant; vol. 23, by the same. London: Eyre & Spottiswoode, and Wyman & Sons, 1898, 1901, 1905. Size 9 × 6, pp. (vol. 20) xxiv. and 1062; (vol. 21) xxvi. and 1298; (vol. 23) xxii. and 1334. *Maps. Price (each vol.) 15s.*

Historical. **Berger.**

Mythische Kosmographie der Griechen. Von Prof. Dr. E. H. Berger. Leipzig: B. G. Teubner, 1904. Size 10 × 7, pp. 42. *Price* 1*m*. 80. *Presented by the Publisher.*

Historical—Early Travels. **Hakluyt.**

The Principal Navigations, Voyages, Traffiques, and Discoveries of the English Nation. By R. Hakluyt. Vol. 9 (pp. xvi. and 474); vol. 10 (pp. xviii. and 502); vol. 11 (pp. xviii. and 458); vol 12 (pp. xiv. and 470). Glasgow: J. MacLehose & Sons, 1904–5. Size 9 × 6. *Maps and Illustrations. Two copies, one presented by the Publishers.*

The last volume consists of an essay by Prof. Walter Raleigh on the English voyages of the sixteenth century, and a complete index to the collection, now supplied for the first time.

Historical—Early Travels. **Purchas.**

Hakluytus Posthumus or Purchas His Pilgrimes. Contayning a History of the World in Sea Voyages and Lande Travells by Englishmen and others. By Samuel Purchas. Volumes 5 and 6. Glasgow: J. MacLehose & Sons, 1905. Size 9 × 6, pp. (vol. 5) xviii. and 530; (vol. 6) xx. and 544. *Facsimile Maps and Illustrations. Price* 12*s*. 6*d*. *net per vol. Presented by the Publishers.*

See note at p. 475, vol. 25. Each volume of the reprint corresponds to a "book" of the original, of which each "part" contained ten, and each volume five.

BIOGRAPHY.

Nasir-i-Khusraw. *J.R. Asiatic S.* (1905): 313-352. **Browne.**

Nasir-i-Khusraw, Poet, Traveller, and Propagandist. By E. G. Browne.

The subject of this notice lived in the eleventh century, and wrote, besides poetry, an account of his extensive journeys through Persia, Asia Minor, Syria, Egypt, Arabia and Bahrein.

Stanley. **Joûbert.**

Joseph Joûbert. Stanley, le roi des explorateurs (1840–1904). Angers: Germain & G. Grassin, 1905. Size 11½ × 7½, pp. 54. *Portrait. Presented by the Author.*

Stübel. *G.Z.* 11 (1905): 129-134. **Wagner.**

Alphons Stübel und seine Bedeutung für die geographischen Forschungsmethoden. Von P. Wagner. *With Plate.*

Suess. *Nature* 72 (1905): 1-3. **Geikie.**

Scientific Worthies. Eduard Suess. By Sir A. Geikie, F.R.S. *With Portrait.*

GENERAL.

Bibliography. **Baschin.**

Bibliotheca Geographica. Herausgegeben von der Gesellschaft für Erdkunde zu Berlin, bearbeitet von O. Baschin. Band 10. Berlin: W. H. Kühl, 1904. Size 9½ × 6, pp. xvi. and 572. *Presented by the Gesellschaft für Erdkunde, Berlin.*

Each succeeding volume of this indispensable work of reference comes nearer the desired end of supplying a complete record of geographical literature. It is particularly valuable for the care which is taken to include occasional papers of geographical interest in non-geographical serials. The number of authors quoted reaches nearly 6000 in the present volume. It is only to be wished that in course of time the issue may take place somewhat nearer the year dealt with.

Bibliography. ———

Amérique, Asie, Afrique, Australie. Voyages, découvertes, ethnographie, géographie, colonisation, navigation. Catalogue de Livres en vente aux prix marqués. Amsterdam: F. Muller et Cie., [1905]. Size 9½ × 6½, pp. 266.

A large number of works of interest to the geographer are here offered for sale, many relating to early voyages and travels.

British Colonies. *J.R. Colon. I.* 36 (1905): 279-333. **Bruce.**

The Crown Colonies and Places. By Sir C. Bruce, G.C.M.G.

Lays stress on the fact that practically all the Crown colonies are in the tropics, and shows their importance as producers of tropical products.

Educational. **Kraentzel.**

Travaux du Séminaire de Géographie de l'Université de Liége. I. La Géographie dans l'enseignement moyen. Par F. Kraentzel. Liége: D. Cormaux, 1905. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. 38.

French Colonies. **Mourey and Brunel.**

L'Année Coloniale, publiée sous la direction de C. Mourey, L. Brunel, en collaboration avec C. Dupontès. Quatrième Année (1902–1903.) Paris: Chevalier & Rivière, 1905. Size $7\frac{1}{2} \times 5$, pp. 340. *Price* 4 *fr. Presented by the Publishers.*

Geographical Names. **Wollemann.**

Bedeutung und Aussprache der wichtigsten schulgeographischen Namen. Von Dr. A. Wollemann. Braunschweig: W. Scholz, 1905. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. 68. *Presented by the Author.*

Intended especially for use in German schools, for which it appears very suitable. It may also be of more general use for purposes of reference, though the names included are limited to those most commonly in use.

World. **Moncrieff.**

The World of To-day. A Survey of the Lands and Peoples of the Globe as seen in Travel and Commerce. By A. R. Hope Moncrieff. Vol. 2. London: The Gresham Publishing Co., 1905. Size $11 \times 7\frac{1}{2}$, pp. vi. and 266. *Maps, Plates, and Illustrations. Price* 8*s. net. Presented by the Publishers.*

See note in vol. **25**, p. 69.

Year-Book. **Keltie and Renwick.**

The Statesman's Year-book, 1905. Edited by Dr. J. Scott Keltie, with the assistance of I. P. A. Renwick. London: Macmillan & Co., 1905. Size $7\frac{1}{2} \times 5$, pp. lvi. and 1424. *Maps. Price* 10*s.* 6*d. net.*

As usual, this is provided with a number of maps illustrating matters of current interest, *e.g.* the distribution of British fleets, sources of meat-supply of the United Kingdom, wheat and cotton producing areas, etc., etc.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R G.S.

EUROPE.

Central Europe. **Liebenow and Ravenstein.**

Liebenow - Ravenstein's Special - Radfahrerkarte von Mittel - Europe. Scale 1 : 300,000 or 4·7 stat. miles to an inch. Sheets: 54, Haag; 67, Ostende; 68, Antwerpen; 81, Calais; 95, Amiens; 137, Orléans; 138, Troyes; 151, Bourges; 152, Autun. Frankfort a.-Maine: Ludwig Ravenstein, 1905.

England. **Bartholomew.**

Bartholomew's New Reduced Survey. Scale 1 : 127,260 or 2 stat. miles to an inch. Salisbury Plain District. Edinburgh: John Bartholomew & Co., [1905]. *Price, mounted,* 2*s. net. Presented by the Publisher.*

England and Wales. **Ordnance Survey.**

Ordnance Survey of England and Wales:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from July 1 to 31, 1905.

1 inch—(third edition):—

In outline, 94, 251. 1*s. each* (engraved).
Printed in colours, folded in cover or flat in sheets, 282. *Price, on paper,* 1*s.; mounted on linen,* 1*s.* 6*d.*

6-inch—County Maps (first revision):—

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N.W., 43 S.E., 44 N.W., S.W., 45 S.W., 47 N.E., S.W., S.E., 49 N.W. (50 N.E. and 51 N.W.), 85 N.E. **Warwickshire and ditto (Det.)**, 14 S.W., 16 S.W., S.E., 19 S.E., 20 N.W., S.W., S.E., 23 N.W., 28 S.E., 42 N.E., 50 S.E. **Worcestershire and ditto (Det.** No. 3), 6 S.W., 18 N.E., 19 S.E., 20 S.E., 27 N.E., 29 N.W., 30 N.W., S.W., 33 N.W., S.W., S.E., 34 N.W., N.E., S.W., S.E., 35 N.W., N.E., S.W., 40 S.E., 41 N.W., N.E., S.W., S.E., 42 N.W., 44 S.E., 47 N.E., S.E., 48 N.W., 54 N.W. **Yorkshire** (First Revision of 1891 Survey), 286 S.W. 1*s. each.*

25-inch—County Maps (first revision):—

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England and Wales. **Geological Survey.**

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Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographischen Abteilung der königlichen Preussische Landesaufnahme. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheets: (plain) 343, Lübben; (brown hills and contours) 382, Brilon. Berlin, 1904–5. *Price* 1.50 *mark each sheet.*

Norway. **Nissen.**

Kart over det Nordlige Norge. Udarbeidet ved Oberst Per Nissen. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. 1905.—Kart over det Sydlige Norge. Udarbeidet ved Oberst Per Nissen. Scale 1 : 600,000 or 9·5 stat. miles to an inch. 4 Sheets. 1903. Christiania: H. Aschehoug & Co. *Presented by the Publisher.*

These are two useful maps for tourists. The second includes the whole of southern Norway up to about 65° 15′ N. lat., and is well drawn; but the first, which is on a smaller scale, is somewhat indistinct and confused as regards place-names and general detail. Both are printed in colours. An index to places accompanies the map of Northern Norway.

ASIA.

Japan. **Japanese Imperial Geological Survey.**

Topographical Map of Japan. Scale 1 : 200,000 or 3·1 stat. miles to an inch. Sheet Murotozaki. Tokyo: Imperial Geological Survey, 1905. *Presented by the Imperial Geological Survey of Japan.*

Manchuria. **Military Information Division, U.S. Army.**

Map showing Seat of War in Manchuria. Scale 1 : 1,000,000 or 15·78 stat. miles to an inch. Prepared in the Second Division, General Staff (Military Information Division), Washington, April, 1905. Supplement to the *National Geographic Magazine*, June, 1905.

This map will doubtless be useful to newspaper readers and others for following the movements of the Japanese and Russian armies. It is based upon the 'Karte von Ost-China,' by the k. Preuss. Landesaufnahme. Hills are shown by horizontal form lines in black.

Selangor. **Revenue Survey Office, Selangor.**

Selangor. Federated Malay States. Scale 1 : 126,720 or 2 stat. miles to an inch. Compiled at the Revenue Survey Office from actual surveys and various explorations. Selangor: Revenue Survey Office, 1904. *Presented by H. Redfearn Shaw, Esq., Superintendent of Revenue Surveys.*

This is by far the best general map of Selangor published up to the present time, and shows clearly the present state of exploration and survey. Many districts are still practically unexplored, and although the best information has been utilized in the construction of the map, much of this is necessarily of an approximate character. Railways, roads and paths, alienated lands agricultural and mining, and information concerning surveys used are shown by different symbols and colours, and there is also a table of statistical information concerning the state. The map is printed in colours by Messrs. J. Bartholomew & Co.

AFRICA.

Africa. **Topographical Section, General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheet 74, Cross River. London: T.S., G.S., War Office, 1905. *Price 2s. each sheet. Presented by the Director of Military Operations.*

Gold Coast Colony. **Guggisberg.**

Supplement sheet to the Tarkwa Mining Map. Corrected to April, 1905, showing Fura-Prestea Tramway. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Compiled under the direction of Major F. G. Guggisberg, R.E., Director of Surveys, Gold Coast Colony. *Presented by Major F. G. Guggisberg,* R.E.

This supplement is on tracing-paper, and can be fitted over the sheet of Major Watherston's map, to which it refers, and which was noticed in the last number of the *Geographical Journal*. The Fura-Prestea Tramway is shown in a bold black line.

Nigeria—Southern. **Woodroffe.**

Map of Southern Nigeria (Provisional). Compiled under the direction of Captain A. J. Woodroffe, R.E. Scale 1 : 500,000 or 7·9 stat. miles to an inch. 2 Sheets. London: Edward Stanford, 1905. *Price* 21*s.*

A comparison of this edition with that published two years ago will show that much additional geographical information has been obtained during the interval. The survey work used in filling in the map varies much in character and degree of dependence; but, apart from more exact surveys and astronomical observations by Captain Woodroffe and Lieut. King, several of the officers and district commissioners at present serving in Southern Nigeria have supplied traverses and compass surveys, which have been made good use of, while the officers of the Marine Department, under Lieut. H. A. Child, R.N., have supplied information regarding the creeks.

Important alterations to the district boundaries are also shown on this map.

Portuguese East Africa. **Commissão de Cartographia.**

Carta de Moçambique. Scale 1 : 3,000,000 or 47·3 stat. miles to an inch. Lisbon: Commissão de Cartographia, 1903.

A small general map of Portuguese East Africa, printed in colours. Many of the place-names are so indistinct that they are almost illegible.

Tunis. **Direction Générale des Travaux Publics.**

Carte routière de la Tunisie au 1er Juillet 1905, dressée par la Direction Générale des Travaux Publics. Scale 1 : 500,000 or 7·9 stat. miles to an inch. Paris: Erhard Frères, 1905.

This map has been specially prepared to show means of communication. Railways, roads, and paths are shown in different colours and symbols according to their character. Post and telegraph stations, caravanserais, triangulation points, and lighthouses are also shown, whilst the general relief of the country is indicated faintly in order that the special information, which the map is intended to convey, should not be obscured.

Tunis. **Service Géographique de l'Armée, Paris.**

Carte de la Tunisie. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheet xxxv., Thala. Paris: Service Géographique de l'Armée, 1905. *Price* 1.20 *fr. each sheet.*

AMERICA.

America. **Service Géographique de l'Armée.**

Carte de l'Amerique. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheets: San Salvador, Tampa. Paris: Service Géographique de l'Armée, [1905]. *Price 1.25 fr. each sheet.*

Although this map bears the title of America, it is really a map of the West India islands, and extends from Florida to Jamaica, and from the Central American coast to Porto Rico. It is produced in a style similar to the corresponding map of Asia published by the same department, and will doubtless be extended in the future. Nearly the whole of the area included in these sheets is occupied by sea.

Argentine Republic. **Entre Rios Railway Co.**

Map of the Entre Rios Railways and neighbouring lines. Scale 1 : 2,090,880 or 33 stat. miles to an inch. London: Waterlow & Sons, 1905. *Presented by Follett Holt, Esq.*

Brazil. **Great Western of Brazil Railway Co.**

Map showing the railways of the Great Western of Brazil Railway Company, Limited, 1905. Scale 1 : 980,000 or 15·4 stat. miles to an inch. London: Waterlow & Sons, 1905. *Presented by Follett Holt, Esq.*

Canada. **Surveyor-General of Canada.**

Sectional map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Tramping Lake Sheet (217), West of Third Meridian. Revised to May 11, 1905. Humboldt Sheet (219), West of Second Meridian. Ottawa: Surveyor-General's Office, 1905. *Presented by the Surveyor-General of Canada.*

Canada. **Department of the Interior, Canada.**

Standard Topographical Map of Canada. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheet 2 s.w., Hamilton, Ontario. Ottawa: Department of the Interior, 1905. *Presented by James White, Esq., Geographer, Department of the Interior, Ottawa.*

Canada. **Department of the Interior, Canada.**

Yukon Territory, Kluane, White, and Alsek Rivers. From Surveys by International Boundary Commission, 1893–95. J. J. McArthur, 1900; A. Talbot, 1899; and J. B. Tyrrell, 1898. Scale 1 : 400,000 or 6·3 stat. miles to an inch. Ottawa: Department of the Interior, 1905. *Presented by James White, Esq., Geographer, Department of the Interior, Ottawa.*

This map extends from Yakutat bay to lat. 62° 45′ N., and from about 137° to 141° W. long. It shows the boundary between Canada and Alaska, following down the 141st degree of west longitude as far as the neighbourhood of Mount St. Elias, and thence east and south-east by Mts. Augusta, Cook, Vancouver, Hubbard, and Seattle, until it reaches the 60th parallel, which forms the boundary between Yukon and British Columbia, and which is followed as far as the 137th meridian. This map is an important one, and gives a considerable amount of additional topographical information. It is well produced.

GENERAL.

World. **Monaco.**

Carte général bathymétrique des Océans, dressée par ordre de S. A. S. le Prince de Monaco d'après le mémoire de M. le Professeur Thoulet, adopté par la Commission de nomenclature Sub-océanique et par le Congrès international de Géographie de Washington (8 Septembre 1904) sous la direction de M. Charles Sauerwein, par M. Tollemer avec la collaboration de MM. Bataille, Bolzé, Lebas, Lévèque, Morelli, Normand. Scale 1 : 10,000,000 or 157·8 stat. miles to an inch. 26 sheets. Monaco: Musée Océanographique, 1905. *Presented by M. Charles Sauerwein.*

This important chart will be specially noticed in the *Geographical Journal.*

World. **Snelling.**

Snelling's Large-sheet Demonstration Tracing Maps, and Comprehensive Tracing and Colouring Maps. Australia; The United States; Spain and Portugal; the Balkan Peninsula; the Mediterranean and Black Seas; Japan, Korea, Manchuria, etc.; Canada; India; France and Switzerland; England and Wales; Scotland; Ireland; Russia in Europe; South-West Asia; Norfolk; Isle of Wight. Wareham. H. Snelling. *Presented by the Publisher.*

A series of roughly drawn outline maps intended for use in schools. The larger maps have no names, while upon the smaller ones the names of some of the principal places are given. The outline is faintly printed in brown, so that the maps can be coloured and completed by the scholars. The idea is, of course, good, but the maps would have been much more useful and instructive if more care had been taken with their production. For instance, the remarkable scratchings which are evidently intended for hill-shading is useless as giving any idea of land relief, and only tends to confusion.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas. 100 Karten in Kupferstich herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha. 47 und 48 Lieferung. Gotha: Justus Perthes. *Price* 60 *pfg. each part.*

These parts contain the following maps: No. 3, The World in Hemispheres, by H. Habenicht; No. 4, The World on Mercator's Projection, by H. Habenicht; No. 68, General map of Africa, on the scale of 1 : 25,000,000, by C. Barich; No. 75, Sheet 7 of a map of Africa on the scale of 1 : 7,500,000, by H. Habenicht.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during May and June, 1905. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3497 m	= 4·2	England, east coast:—Hull road. 1*s*. 6*d*.
3498 m	= 2·9	Sweden, east coast:—Stockholm Skärgärd. 2*s*. 6*d*.
3501 m	= { 1·4, 5·0, 10·0 }	Baltic, Gulf of Bothnia: Approaches to Nystad (Plans:—Fair-way near Iso-Varestus. Anchorage on west coast of Lökö island. 2*s*. 6*d*.
3503 m	= 1·0	Germany, north coast;—Gulf of Danzig, western part. 1*s*. 6*d*.
92 m	= 0·2	Spain, south-west coast:—Cape St. Vincent to strait of Gibraltar. 2*s*. 6*d*.
2822 m	= 3·76	France, south coast:—Gulfs of Napoule and Juan, including Cannes and Antibes. 2*s*. 6*d*.
3496 m	= 1·4	Greece, west coast:—Scropha point to Cape Kamilafka. 2*s*. 6*d*.
3483 m	= 0·48	Black sea:—Cape Lukul to Cape Meganom. 2*s*. 6*d*.
3502 m	= 6·25	West Indies, Puerto Rico:—Guanica harbour. 2*s*. 6*d*.
3495 m	= 7·27	West Indies, Leeward islands. Bicques or Crab island:—Port Mulas and approaches. 1*s*. 6*d*.
136 m	= 0·89	Bay of Bengal:—River Húgli—Saugor point to Calcutta. 2*s*. 6*d*.
3481 m	= 0·5	Bay of Bengal:—Moulmein river to Yé river. 2*s*. 6*d*.
3489 m	= 2·1	Bay of Bengal, Tenasserim:—Hinzé basin. 2*s*. 6*d*.
3504 m	= 23·0	Indian ocean, Christmas island:—Flying Fish cove. 1*s*. 6*d*.
3400 m	= var.	Eastern archipelago:—Plans of anchorages between Celebes and New Guinea. 1*s*. 6*d*.
3487 m	= 2·4	Philippine islands, Luzon island:—Manila and Kavite anchorages. 1*s*. 6*d*.
3039		Arctic sea, Novaya Zemlya. Plan added:—Lyamchina bay.
2221		Black sea, plans of Russian ports on the north shore. New plan:—Mzuimta road.
3411		Africa, west coast. Garraway anchorage. Plans added: Rock-town Berebi anchorage. Grand Berebi anchorage. Sassandra anchorage. Port Bouet.
219		Malacca strait, Acheh head to Diamond point. Plan added:—Lampujang strait.
2201		Sumatra, plans in. New plan:—Simalur island or Pulo Babi.
928		Borneo island, Sulu archipelago. New plan:—Maibun anchorage.
2196		Celebes. Sketch-plans of anchorages in southern part. Plan added:—Bintaru anchorage.
3274 m	= { 0·2, 5·0, 10·0, 3·0 }	China, Yangtse river:—Tung-ting lake and Siang river, Sha nie Kan, Liu cha po. Chang sa. 2*s*. 6*d*.
836		Japan, Amakusa islands and Yatsushiro sea. Plan added:—Kuro seto.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.	Cancelled by	No.
109 Kingston - upon - Hull. Plan on the sheet.	New plan. Hull road	3497
92 Cape St. Vincent to strait of Gibraltar.	New plan. Same title	92
2822 Port Cannes, Golfe Jouan, and Port Antibes.	New plan. Gulfs of Napoule and Juan, including Cannes and Antibes	2822
479 Puerto de Guanica. Plan on this sheet.	New plan. Guanica harbour	3502
136 River Húgli.	New plan. River Húgli	136
941*a* Flying Fish cove. Plan on this chart.	New plan. Flying Fish cove	3504
930 Gisser island. Plan on this sheet.	New plans of anchorages between Celebes and New Guinea	3440
976 Plan on this sheet:—Port of Manila.	New plan. Manilla and Kavite anchorages	3487
3274 Tungting lake and Siang river.	Tungting lake and Siang river, Sha nie kan, Lui cha po, Chang sa	3274

Charts that have received Important Corrections.

No. 3261, Germany:—Elbe river, outer light-vessel to Brunsbüttelkug. 1479, Norway:—the Naze to the North cape. 2306, Norway (Sheet 4):—Romsdals islands to Hitteren island. 3435, Plans on the east coast of Sweden. 2300, Baltic, Gulf of Bothnia (Sheet 5):—Stiernö point to Fiäderäg, etc. 2247, Gulf of Finland:—Hogland to Seskär, north shore. 798, France, west coast:—Douarnenez bay and approach. 1755, Spain, north coast:—San Ciprian bay to Cape Finisterre. 2235, Black sea (Sheet 6):—Fort Anakria to Kertch strait. 577, British Columbia:—Inner channels leading from Juan de Fuca strait to Haro strait. 395, Africa, west coast:—Isles do Los, etc. 1174, Africa, west coast:—Bonny, New Calabar, and Sombrero rivers. 641, Africa, south coast:—Port Elizabeth. 143, Red sea:—Jebel Teir to Perim island. 901, Red sea:—Sawákin harbour. 1884, Bay of Bengal:—Arakan river, Akyab. 2104, Eastern archipelago, Borneo island (Sheet 1:—South Natuna islands. 2987, Philippine islands:—San Pedro bay to Libukan islands. 1742, China, Canton river (Sheet 4):—Second bar pagoda to Whampoa, etc. 1739, China, Canton river (Sheet 5):—Whampoa channel and Changshan island to Canton. 1601, China, north-east coast:—Wusung river. 61, Japan:—Harbours and anchorages on the north-west coast of Nipon. 3109, Japan:—Yokohama bay. 2294, Pacific, Sandwich islands:—Pear river and lochs.

(*J. D. Potter, Agent.*)

Chile. **Chilian Hydrographic Office.**

Chilian Hydrographic Charts, Nos. 101, Estero Comau o Leptepu; (Provisional) 113, Tierra del Fuego. Puertos del Canal Cockburn; (Provisional) 120, Magallanes. Puertes del Seno Otway. Valparaiso: Oficina Hidrografica, Marine de Chile, 1905. *Presented by the Chilian Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for July and August, 1905. London: Meteorological Office, 1905. *Price 6d. Presented by the Meteorological Office, London.*

North Atlantic. **U.S. Hydrographic Office**

Pilot Chart of the North Atlantic Ocean for June and July, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office**

Pilot Chart of the North Pacific Ocean for July and August, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

ILLUSTRATIONS.

Baltistan. **Duncan.**

Six photographs of Baltistan, taken by Miss Duncan. *Presented by Miss Duncan.*

The value of these interesting photographs is greatly increased by the full and careful descriptions which have been written on them. The following are the brief titles:—

(1 and 2) Ancient barrage at Sadpor Tso, near Skardo; (3) Door in buttress of former sluice-gates at Sadpor Tso; (4) Buttress of sluice-gates at Sadpor Tso; (5) Sadpor Tso; (6) Carving on rock near Skardo.

Canada. **Harrison and Mathers.**

Thirty-seven photographs of North-West Canada. *Presented by A. H. Harrison, Esq.*

These photographs were brought back by Mr. A. H. Harrison upon his return from his sporting expedition in 1903. Several of them were taken by Mr. Harrison himself, and others bear the name of C. W. Mathers, of Edmonton. The views of the Great Slave and Athabasca lakes and Mackenzie river are very good, and altogether they give an excellent idea of the character of the country and means of transport by land and water.

(1) The Boiler rapids on Athabasca river; (2) View of the island in the Grand rapids, Athabasca river; (3) Grand rapids, Athabasca river; (4) The foot of Grand rapids; (5 and 26) Traders' boats running rapids; (6 and 7) Tracking on the Athabasca river; (8 and 9) Fort Chippewayan on Athabasca lake; (10) Feeding the dogs; (11) On the shore of the Mackenzie river; (12) Indian fishing through the ice, Mackenzie river; (13 and 14) The "Ramparts," Mackenzie river; (15) Rapids on Slave river; (16 and 17) Fort Resolution; (18) Great Slave lake from Fort Resolution; (19) A trader's post at Fort Resolution; (20) View of Great Slave lake; (21) Skin lodges near Great Slave lake; (22) A scow running rapids on Slave river; (23) Fort Smith landing, Slave river; (24) Hudson Bay Company's transport on Smith portage; (25) Dog-rib Indians on Great Slave lake. Others with no titles.

China. **Hamilton.**

Thirty photographs of China, taken by Major A. B. Hamilton, 1902. *Presented by Major A. B. Hamilton.*

The journey during which those photographs were taken extended from Fuchau to Kiu-kiang on the Yangtze kiang, by a route, if not altogether new, but little traversed in some parts. It is described in the *Geographical Journal* for July last, which also contains reproductions of some of these photographs. The titles are as follows:—

(1) The Min river just above Sui-kau; (2 and 3) The Min river between Sui-kau and Yen-ping; (4) Approaching Yen-ping; (5) The Min river leaving Yen-ping; (6) Kien-ning looking down from the city walls; (7) Kien-yang; (8) Bridge over Siu-nam at Kien-yang; (9) Crowd at Kien-yang; (10) Between Kien-yang and Chung-an; (11) River at crossing between Kien-yang and Chung-an; (12) Between Kien-yang and Chung-an; (13) Method of carrying tea; (14) Method of carrying live pigs; (15) Valley above Chung-an; (16) Lower eastern slope of Bohea hills; (17) Bridge near Tai-an-kwan; (18 and 21) Bohea hills; (19) Gateway at summit of pass between Fukien and Kiangsi provinces; (20) Summit of pass looking towards Kiangsi province; (22) Bohea hills looking towards Fukien province; (23) Method of hauling a wheel-barrow in the hills; (24) Anren; (25) Sui-fung; (26) Sung-gong; (27) Approaching Tu-chang, Poyang lake; (28) Poyang lake near Sar-sam; (29) Sar-sam; (30) Rock in Poyang lake near Nan-kang.

Egyptian Sudan. **O'Sullivan.**

Four photographs of Dar Nuba, Egyptian Sudan, taken by Captain H. D. E. O'Sullivan, R.M. *Presented by Captain H. D. E. O'Sullivan, R.M.*

(1) View at Gebel Kadugli, looking south; (2) View at Gebel Kadugli, looking north; (3) Gebel Kadugli; (4) Gebel Talodi.

Greenland. **Pocock.**

Seven water-colour panoramas of the west coast of Greenland. *Presented by Roger Pocock, Esq.*

An excellent series of water-colour sketches of scenery on the west coast of Greenland, made during a cruise of the barque *Thorraldsens* in June and July last year. The sketches are accompanied by a tracing of a chart showing the track followed and the places visited.

Malacca. **Bland.**

Album of forty-nine photographic reproductions of Historical Tombstones of Malacca. *Presented by the Crown Agents for the Colonies.*

In this album Mr. R. N. Bland has brought together a most interesting collection of photographs of early Portuguese and Dutch memorial stones to be found in Malacca. Some few are so worn that the inscriptions are undecipherable, but others are perfectly sharp and clear. In his introductory notes the author states that he has thought it possible that these few surviving memorials of the founders of European dominion in the Far East may be found interesting, and acknowledges his indebtedness to Messrs. Copley, Pringle, and Howell for assistance in taking the photographs, as well as to the Rev. R. E. S. Affonso, Vicar of the Portuguese Church of St. Peter, Malacca, for help in deciphering the Portuguese inscriptions.

Western Tibet. **Rawling.**

Seventy-one photographs of Western Tibet, taken by Captain C. G. Rawling in 1903. *Presented by Captain C. G. Rawling.*

The surveying expedition upon which these photographs were taken was described in the *Geographical Journal* for April last. The photographs are most important from a geographical point of view, and are of exceptional interest inasmuch as they represent a region that is very imperfectly known. Twenty-one of the number are panoramic views, and give an excellent idea of the character of the country.

(1) Watering ponies; (2) Hired yak transport at Tankse; (3) Feeding ponies in the Chang-chenmo valley; (4 and 5) Shoeing ponies at Leh; (6) Looking north from Deasy group; (7 and 9) Wild yak; (8) Kheo valley above Noh; (10) Young tame yak; (11) View looking west, Lake Markham in the distance; (12) An old man; (13) The "bad" pass, west of Nemar Chaka; (14) Shoeing ponies; (15) An anxious moment, digging for water; (16–18) Clouds forming over Deasy group; (19) Tibetan ponies; (20) Our ponies in Leh serai; (51) Tso-mo Gualari; (22) Lieut. Hargreaves crossing the Marai-mik La; (13) Captain Rawling and Sunam Toering, 18,400 feet high; (24, 27, and 46) Western Tibetan scenery; (25) Camp on the Kheo river; (26) A halt by the way; (28) Digging for water; (29) Huping Tso; (30) Aru Tso mountains; (31) Beach-marks, formed by receding water; (32) Hog-backed spur near Lake Markham; (33) Pass into the Arport Tso mountains; (34) Arport Tso; (35) Memar Chaka mountains; (36) Alung, Kangu range in the distance; (37) Part of Lake Markham; (38) Kiang plain; (39 and 49) Tibetan antelope; (40) Ram Singh; (41) Yak's horns; (42) Tibetan nomad firing; (43) Tibetan nomads; (44 and 45) Yaks crossing snow in Chang-chenmo valley; (47 and 52) Aru Tso, lake and mountains; (48 and 51) Shemen Tso; (50) Looking north from Deasy group; (53) Our Tibetan captors; (54) Arport Tso from the east; (55) View across Memar Chaka to Aru Tso range; (56 and 57) Cliff between camps 18 and 19; (58) Mangtsa Tso; (59) Tibetan family of nomads near Aru Tso; (60) View in the Kwen Lun range; (61) View looking towards the Aru Tso range; (62) Gore Tso, frozen; (63) Lake Markham, looking south-west; (64) Lake Markham, looking north; (65) Lake Markham, looking east; (66) Between Camps 13 and 14; (67) Tsaggar Tso; (68) Looking west from Lanak La; (69) Salt lake near Aru Tso; (70) Huping Tso, looking east; (71) View from summit of peak in Deasy group, 20,000 feet.

West Indies. **Varley.**

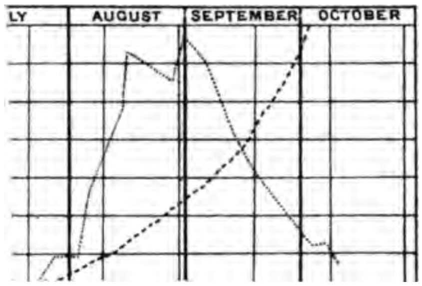
Forty-two photographs of the West Indies, taken by F. G. Varley, Esq., M.A. *Presented by F. G. Varley, Esq., M.A.*

A set of small photographs taken by Mr. Varley during a short visit to the West Indies in the early part of the present year. The views of the ruins of St. Pierre are specially interesting.

(1) Road in Barbados; (2) Cotton-picking in Barbados; (3) Harbour, St. Vincent; (4) St. Vincent; (5) Botanical gardens, St. Vincent; (6) Nutmeg tree; (7) Bamboos; (8) Forests, St. Vincent; (9) Dominica; (10) Botanical gardens, Dominica; (11) Flowering palm, Dominica; (12) Fan palm, Trinidad; (13) Botanical gardens, Trinidad; (14) Blue basin, Trinidad; (15) Road to Blue basin, Trinidad; (16) Pitch lake, Trinidad; (17) New pitch welling up, Pitch lake; (18) Digging pitch, Pitch lake; (19) Pitch refinery, Trinidad; (20) New Brighton, Trinidad; (21) Hills, St. Lucia; (22) Harbour, St. Lucia; (23) Fort de France, Martinique; (24) St. Pierre, Martinique; (25 and 26) Ruins of St. Pierre; (27) Ruined house, St. Pierre; (28) Ruined chapel, St. Pierre; (29) Ruined factory, St. Pierre; (30) Ruins of cathedral, St. Pierre; (31) Mont Pelée from the sea; (32) Entrance to Havana harbour; (33) Morro castle, Havana; (34) Native craft in Havana harbour; (35) Bridge of boats, Curaçoa; (36) Main street, Curaçoa; (37–39) Rio Cobre, Jamaica; (40 and 41) Bog walk, Jamaica; (42) Spanish bridge over Rio Cobre, Jamaica.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

‾BARA DISCHARGE 1903. FIG. III.



The

Geographical Journal.

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EXPLORATION AND SURVEY WITH THE TIBET FRONTIER COMMISSION, AND FROM GYANGTSE TO SIMLA VIÂ GARTOK.*

By Major C. H. D. RYDER, D.S.O., R.E.

I. The Main Expedition.

It has been said that the geographical results of the expedition to Lhasa have been disappointing. No one was better pleased than myself that this was in a sense true. Our knowledge of the country lying between our frontier and Lhasa depended chiefly on the surveys executed by different explorers trained by and working under the supervision of officers of my department—the Survey of India. They worked under extraordinary difficulties, and in great danger of their lives. That, when at last we have been able to carry through a regular and systematic survey of the country, we have not been able to find that the rough maps prepared from these explorers' surveys were in any important points other than very fairly accurate, reflects the very highest credit on these men, notably the late Pandit Nain Singh and the explorer A.-K., the latter of whom is still alive. In place of these rough maps, we have now an accurate survey of the country traversed by the expedition.

On September 24, 1903, I received orders at Bangalore to join the Tibet Frontier Commission at Kampa Dzong. Proceeding *viâ* Calcutta, where I had to spend a few days collecting instruments and kit, I arrived at Silliguri, the railway base, on October 3, and marched out the same afternoon to Sevoke, where the Teesta leaves the hills. This was not the time of year to see the Teesta valley at its best; very hot,

* Read at the Royal Geographical Society, May 15, 1905. Maps, p. 480.

raining nearly every day, the march up the valley was far from pleasant. The cart road, now open as far as Gangtok, was then constantly blocked by landslips, and very slippery. After Gangtok was passed the views of the snows should have been magnificent, but the higher hills were veiled in clouds. All the more pleasant, therefore, was the marked change once the frontier pass, the Kangra La, was crossed; clouds were left behind, and during the two months I stayed at Kampa Dzong we had nothing but the finest weather, with that wonderful clear atmosphere which every traveller in Tibet has remarked on.

Down the long slope from the Kangra La, and over the rolling downs near the valley of Giri, the great snowy range gradually opened out, till on reaching Kampa Dzong, or at any rate from the hill above it, one continuous line of snows was visible stretching from Chumolarhi to Mount Everest, a distance of some 150 miles. We were able to survey from this snowy range northwards to the Arun river—Tsangpo watershed, the Tibetans, beyond sending men to watch us, making no attempt to stop us surveying so long as we did not camp away from the mission post.

As regards the heights of peaks, our results were of a negative nature. The highest point on the above-named watershed was 20,100 feet; the two "very high snowy mountains" mentioned by Mr. Freshfield on p. 362 of the *Geographical Journal* for March, 1904, quoting from one of the explorers, were disappointing, being only 21,200 feet in height. The fine snowy range apparently running north from Everest, but in reality running north but some 30 miles east of Everest, has its highest summit at an elevation of 22,200 feet. In the photograph by Mr. Hayden (*R.G.S. Journal*, March, 1904), it will be noticed that the northern side (*i.e.* the right-hand one in the photograph) of Everest has a continuous slope, which I estimated at 7000 feet; and it is extremely unlikely that north of Everest, and hidden by the nearer snowy range (on the right edge of the photograph), the peaks could again rise to a height anywhere approaching that of Everest. It is interesting here to note that Everest, as viewed from Kampa Dzong, does not appear as the highest peak of a group, but as one massive summit standing by itself. Nowhere could we hear of any local name for Everest, although careful inquiries were made. The height of Kampa Dzong itself proved to be 15,200 feet instead of 13,800, as on previous maps.

Fortunately, just as we had completed all the surveying possible from Kampa Dzong under existing circumstances, it was decided that the mission should retire from Kampa Dzong and advance over the Dzelap La and up the Chumbi valley. We accordingly hurried across Sikhim and caught up the main body of the mission and its escort at Chumbi. This valley is disappointing; it has always had a great reputation, but we found it to be only 200 or 300 yards wide, and not very rich. The houses at Rin-chen-gong are good, but that is not due to any richness in the valley itself, but to the fact that the Tomos, the inhabitants of the valley, have a monopoly of the carrying trade from Phari Dzong down into Sikhim.

A short halt here enabled me to get the lower end of the valley surveyed, and to detach Sub-Surveyor Dalbir Rai, who followed the valley down to the plains, and, returning to Gnatong by the adjoining valley, completed a most useful piece of work, including a hitherto unsurveyed portion of Bhutan.

The mission then moved up to Phari Dzong and over the Tang La (height 15,200 feet), a very easy pass to Tuna (height 14,800 feet).

GYANGTSE.

Here we spent the winter, and, except for some work in the Chumbi valley, surveying was nearly at a standstill; the Bhutan snowy range on the east, lower rounded hills on the west, and the Tibetan force at Guru, 6 miles north of us, limited our sphere of observation. The cold was intense, and a very unpleasant three months were spent before we again advanced. Towards the end of March Mr. Hayden, of the Geological Survey, and I, with an escort of twenty rifles, made a short excursion across the plain to explore the Lingshi La, a pass crossing the snowy range into Bhutan. Before, however, reaching this point, we were met by a small Tibetan force and requested to return. In view of my knowledge that Colonel Younghusband was very anxious to avoid, if possible, a collision with the Tibetans, I decided to retire to Tuna.

General Macdonald and the main force having arrived at Tuna, it was decided to make a preliminary advance to Guru, where the Tibetans were encamped, and establish a post there. Unfortunately for them, the Tibetans decided to oppose our advance. A short fight took place, in which the Tibetans suffered heavily. On April 2 Captain Cowie joined us, just in time for the advance to Gyangtse, which took place on April 4.

We camped on April 4 at Guru; we then marched round the shore of the Bam Tso to Chalu, and the following day did a short march down the narrow valley along which the stream flows connecting the Bam Tso with the Kala Tso. I ascended a point on the range between the two lakes, and had a fine view down on to both of them. The Bam Tso has an area of about 25 square miles, and the Kala Tso of about 15 square miles. Next day, April 7, we had a level march to Mangtsa, where the open country ends. There is no outlet to the Kala Tso, but there are obvious signs that in ancient times the water flowed out of the lake into the narrow gorge, and so to Gyangtse and the Tsangpo. About 8 miles from the lake in this direction a small stream rises from what is probably an underground flow from the lake, and flows in a broad and deep bed down the gorge.

From Mangtsa the force marched to 3 miles short of Kangma, down a narrow gorge, while Captain Cowie and I ascended the range to the east to a height of about 18,000 feet, to try and get a view ahead. In this we were not successful, still higher hills on the north on both sides of the gorge blocking our view. The Tibetans were reported by the mounted infantry to be in force holding a wall across the valley at Kangma; but next day their position, a strongly built wall, which, however, could have been easily turned, was found evacuated. Next day they were located in a position holding a narrow gorge known as the Red Idol gorge, and the precipitous hills on either side. Out of this they were easily turned by a direct attack and a long flanking climb on the part of the Gurkhas. We camped at Sapu that evening, and marched on to the Gyangtse plain the following day. On April 11 the dzong, or fort, of Gyangtse was surrendered by the Tibetans, who seemed cowed by the defeats they had received. The mission was established in a village on the right bank of the Nyang Chu, where there is a bridge, and about 1000 yards from the dzong.

A force under Colonel Brander was left as escort, while the General and the main force returned to the Chumbi valley, leaving posts at Kangma, Kala Tso, and other places on the line.

We now settled down to a peaceful existence. A bazaar was established outside the post, and officers in small parties could wander about the plain shooting.

Captain Cowie and I were then able to start triangulation off a measured base, and, with the help of three stations on the hills, were able to complete all the work that was possible; but we were not then able to connect this triangulation with my Kampa Dzong and G.T. peaks, but we fixed some peaks on the Karo La range, which afterwards proved invaluable in connecting the Lhasa triangulation with this work.

Towards the end of the month a report came in that a force of Tibetans had collected on the Karo La, 45 miles from Gyangtse, on the road to Lhasa. A party, consisting of fifty men of the 32nd Pioneers and thirty mounted infantry, under Lieut. Hodgson, was sent out to verify this report. As this would afford an opportunity of getting in a good addition to our map, I decided to accompany the party with Captain Cowie.

We reached Ralung, two long marches from Gyangtse, on April 29, and the following day, accompanied by the mounted infantry, rode up to the pass, about 2 miles beyond which we saw the wall which the Tibetans had built. Lieut. Hodgson took a few men forward to draw their fire and make them disclose their strength. In this he was successful, and withdrawing his men without loss, although some Tibetans concealed on the hills above were rolling rocks down on him, we rode back to Ralung. I had intended taking the mounted infantry to Kangma in one long day's march, as it was important to have this route reconnoitred, but, owing to the presence of the Tibetans in such force on the Karo La, this was not now considered advisable, and we returned to Gyangtse in two marches, arriving there on May 2.

Colonel Brander decided to take out a force to turn the Tibetans out of their position on the Karo La, as they were threatening our line of communications. On May 3 he accordingly started, Captain Cowie again accompanying, as I hoped he might be able to get the route from Ralung to Kangma done this time. They attacked the Tibetans on the 6th, and drove them out of their position, but, owing to our having in the mean time been attacked at Gyangtse, Captain Cowie had to return with the force.

On the 4th everything at Gyangtse seemed peaceable. I had been out for a long day surveying on the hills to the south, and on my return heard of a report, originating from one of the patients in Captain Walton's civil hospital, that we were to be attacked next day. A small mounted infantry patrol went some miles down the Dongtse road, but found nobody. The Tibetan force, however, was at Dongtse itself, and, leaving when the moon rose about 1 a.m., attacked us just after dawn. Their attack was a complete surprise, but once our men turned out, the Tibetans were easily driven off with heavy loss. If, however, the Tibetans had not given the alarm by shouting and firing their guns, but rushed in with their swords, we should have been in a rather awkward position. Another force of theirs had in the mean time occupied the dzong, from whence they opened a heavy fire, which, to every one's surprise, more than reached our post. The fighting in and around

Gyangtse has been already often described; it culminated in the capture of the dzong on July 6.

Captain Cowie and Surveyor Sher Jang, who had come up with the relief force, now rejoined me, and on July 14 we commenced our march to Lhasa. Owing to the cloudy weather rendering triangulation impossible, I thought it advisable, in case we could not afterwards connect Lhasa and Gyangtse by triangulation, to run a subtense bar traverse; this entailed Captain Cowie and I being on the road all day, starting with the advance guard and getting in in the evening. The weather, too, was very bad, heavy rain falling almost every day, effectually dispelling the prevailing notion that this part of Tibet is a rainless country.

The Karo La (height 16,200 feet) was crossed on July 18, the bulk of the Tibetans holding the position bolting the night before from the wall in the valley, leaving their companions on the hills to their left to escape as best they could. They were easily driven out of their position by the 8th Gurkhas, who, however, established a record in hill fighting at high altitudes, the Tibetan position reaching an elevation of 18,500 feet, and their retreat leading across the face of a glacier.

The next day the force moved to Nangkartse Dzong, in sight of the Yamdrok Tso. The snow-peak marked in former maps in the centre of the promontory, round which the Yamdrok Tso makes an almost complete circle, is a myth. No hill there has permanent snow, though, as their height is about 17,000 feet, there doubtless is often snow lying there when there is none at Nangkartse Dzong, or on the shore of the lake (height 14,350 feet). After a day's halt we marched to Yarsik, where the original outlet of the lake obviously existed. We then marched for two more days along the shores of the lake, which all along this part is never more than 2 or 3 miles wide, and very often less.

We crossed the Kampa La (height 15,400 feet) on the 24th, an easy ascent from the lake-side, but a very long drop down to the Tsangpo. Owing to the low elevation (11,550 feet) and Sarat Chandra Das's description, I thought that the valley would have been well wooded; this, however, was not so: the hills were quite bare, and no trees grew wild, though round every village there were fine groves. We moved on 6 miles down the river to the place selected for the crossing, where the Tibetans had kindly left a large ferry boat on our side of the river.

The whole force had crossed on the 30th, a very laborious process. The valley here is broad and well cultivated, the river running in most places in several broad channels, with sandy islands in between. It was about at its highest flood-level soon after we had all crossed, with a very fast current and deep, and 140 yards wide.

On July 31 we moved off, and after a few miles turned up the Kyi Chu, a well-cultivated valley with a broad shallow river resembling the Tsang-po valley on a slightly smaller scale.

On August 2 we arrived at the Tolung Chu, a large affluent of the Kyi Chu, and over which there is quite a good bridge. From here we were rewarded by our first sight of the Potala, the residence of the Dalai Lama, situated on a small isolated hill overlooking Lhasa.

Next day camp was moved to within a mile of the Potala; this was, however, only a temporary camp, and, being swampy, another site was selected on drier ground north of the town, the mission being located in a very good house in pretty wooded grounds outside the town. The weather was not favourable for surveying—rain fell constantly, and

BRIDGE OVER THE NYANG CHU ADJOINING OUR POST, WITH GYANGTSE DZONG IN BACKGROUND.

heavy clouds lay on the surrounding hills—so Captain Cowie and I confined ourselves, after measuring a base, and observing a latitude and azimuth, to the survey of the town and suburbs of Lhasa on the scale of 6 inches to the mile. This took some time, as we were at first not allowed to enter the town itself; but later on, having got in all the somewhat extensive groves, gardens, and summer residences outside the town, we were allowed to march through the streets with an escort. In order to avoid attracting attention, for this portion of the work we did not use a plane-table, but made a compass and pace traverse from one fixed point outside through to another fixed point on the other side. The inhabitants showed some curiosity, but no hostility, at our proceedings. The height of the plain above sea-level is 11,830 feet. Captain Cowie left Lhasa on August 29 to return to Gyangtse, to try and secure the connection in the triangulation between that town and the points I had fixed from Kampa Dzong. The weather now began to improve, and I was able to go out with a small escort, firstly, up the valley a day's march, from whence I took mounted infantry up to the junction of the Penbo Chu with the main valley, just opposite the Garden Monastery and some 30 miles from Lhasa; and, secondly, up the Tolung Chu, a somewhat similar expedition.

Having done these two trips, there only remained to go up on to the Penbo La, the pass on the main road leading north from and about 10 miles from Lhasa. This was important for the triangulation, and I was lucky to do all that was necessary in a short spell of fine weather, which just coincided with the five days I spent in camp at the foot of the pass, climbing an 18,000-feet hill each day.

From this range we were able to sketch in carefully the adjoining valley to the north, a broad, well-cultivated, and thickly populated plain; and from three stations I was able to connect on with the peaks of the Karo La range, and also to fix many points north and eastwards, including some fine snow-peaks south of the Tengri Nor, mentioned by Mr. Littledale, the highest of which was 23,250 feet in height, and the highest peak we ever came across north of the Tsangpo. Two other snow-peaks which I fixed are, I believe, those mentioned by M. Bonvalot, and christened by him Mount Huc and Mount Gabet; but their heights were disappointing, the highest being 21,500 feet.

The treaty had been formally signed at the Potala on September 7, and on the 23rd we left on our return march. On this occasion we recrossed the Tsangpo 10 miles higher up, and crossed the range between it and the Yamdrok Tso by the Do La, 16,000 feet, a long steep climb from the river. From this pass, the weather being clear, I had a fine view, and was able to fix a station by observations to peaks on the Karo La range and to two Bhutan peaks, already fixed from India, being also able to see and observe to one of my stations on the hills north of Lhasa. I had gone on ahead of the main force, with an escort of one hundred Gurkhas under Major Row. Next day we marched along the lake to Yasik, and I went up on to the range again, and, observing from two more stations, completed a good area of triangulation, and secured the required connection between the triangulation done from Gyang-tse and that done at Lhasa.

At Yasik on September 30 we met Captain Cowie, who, though much hampered by the cloudy weather, had effected a satisfactory connection between the Gyangtse triangulation and the Kampa Dzong work. We here struck off the main route up the side valley, across a very low, in fact almost inappreciable, watershed, and followed down the narrow valley known lower down as the Rong Chu, which flows into Tsangpo. I have no doubt whatever that this is the old outlet of the Yamdrok Tso, which now is land-locked. Next day we left the valley, camping near the Nyadong La, crossed the pass next day (height 16,000 feet), and so on to the plain above Ralung. This survey was useful, in that it showed the possibility of turning the Karo La. Captain Cowie then made a round from Ralung into the Niru valley, down to Gobshi, and so to Gyangtse, while I caught the general up on the main road, and accompanied the main force. I now made arrangements for Captain Cowie to complete the work remaining between here and Chumbi, on which he writes as follows:—

"On October 8, with Sub-Surveyor Hazrat Ali and a portion of the survey detachment, I left Gyangtse for Kangma, which was reached next day. Commencing a route-survey from this village on the 10th, we struck off the line of communications, marching eastwards through a narrow defile in the bare rocky hills dividing the waters of the

THE CROSSING OF THE TSANGPO OR BRAHMAPUTRA.

Nyang Chu and the Niru Chu. As far as the Nilung La, which we crossed the same day, we followed the track which is part of the main road from Kangma to Ralung *viâ* the Wogya La. After crossing this pass and descending into the open plain, which receives the headwaters of the Niru Chu, we turned southwards, heading for the Rham Tso. Passing over the low rolling hills which intervened, we reached the lake on October 14, completing the survey of this locality, and fixing the position of the Yu Tso, a lake lying at the foot of the snowfields of the big range, culminating further to the south-west in Chumolhari. On the 14th I got into communication with the headquarters staff, who had just reached Kala Tso, and, for the purpose of adding to the half-inch survey of the Khambu valley, obtained sanction to strike off the line of communication at Tuna, and, crossing a pass some 12 miles west of the Tang La, to follow the course of Khambu Chu, eventually rejoining the line at Chumbi.

"Surveyor Shar Jeng, who had accompanied the force from Gyangtse as far as Kala Tso, joined me at Chalu on the 14th. On the 16th we left Tuna, taking with us from there a Tibetan who professed to know the hills to the east of Powhanri, and camped in the small valley below the pass.

"On the evening of the 16th snow began to fall, and by the 17th and 18th a severe blizzard had set in. We left camp on the 17th in the midst of it, purposing to cross over into the Khambu valley, but were unable to reach even the pass. In consequence of mist and the thick driving snow, it was impossible to see more than a few yards in any direction; we had no track to guide us, and the snow was nowhere less than 2 feet deep. The difficulties of progressing were great, and in addition we, the guide included, lost our way. Though only a few of the party were frost-bitten, many had begun to suffer from snow-blindness. Finding it impossible to proceed, with much trouble we eventually got back on the 18th to a point near our camping-ground of the 16th. Next day, with over 50 per cent. of the party incapable from snow-blindness, we crossed the Tang La and reached Phari in the evening. On the 22nd I reached Chumbi, and reported to the G.O.C. (the telegraph line having been broken by the storm), who had sent out a search party for us from Chumbi.

"All of the party had recovered from snow-blindness and the effects of exposure sufficiently to move to Chumbi on the 26th. The whole of the survey detachment left Chumbi on the 28th, and, marching *viâ* the Nathu La and Gangtok, reached Siliguri on November 5."

The survey results of the expedition are as follows :—

Triangulation.—An area of 45,000 square miles was completed, connecting Lhasa with India, and fixing all prominent peaks which were visible, with their heights.

Topography.—An area of 17,000 miles was surveyed on the scale of 4 miles to the inch, of which 3000 square miles, in the neighbourhood of the Chumbi valley, Gyangtse, and Lhasa, were also surveyed on the scale of 2 miles to the inch.

Route surveys, on the scale of 1 inch to the mile, were made of the road to Lhasa.

Large-scale plans were also made of the towns of Gyangtse and Lhasa.

II. From Gyangtse to Simla viâ Gartok.

When the treaty was signed at Lhasa on September 7, 1904, it was decided that a party should proceed to Gartok to examine the place, as it was one of the trade marts which the Lhasa Government had decided should be opened in Tibet. It was obvious that this would afford a great opportunity of adding to our geographical knowledge of the country. The ostensible object of the journey being a political outcome of the treaty, Captain Rawling, of the Somersetshire Light Infantry, who in 1903 had made a remarkable and useful journey in Western Tibet, and

ERODED HILLS OF THE SUTLEJ VALLEY.

CHUMIUMO, OVERLOOKING PASS TO KAMPA DZONG.

Photograph by H. H. Hayden.

CHUMOLARHI (to the right) AND SNOWY RANGE AS VIEWED FROM TUNA.

Photograph by H. H. Hayden.

who was now deputed to open the trade mart at Gartok, was placed in general control of the expedition. He was assisted by Lieut. Bailey, 32nd Pioneers, one of the few officers who have acquired a knowledge of the Tibetan language, which proved very useful to us; the survey party consisting, besides myself, of Captain H. Wood, R.E., and Sub-Surveyor Ram Singh, R.S.

In making our arrangements for the journey, two considerations were paramount—firstly, that we should be having a race against winter, with a possibility that, should we be unable to get over the passes into India before the winter snow fell, the unpleasant prospect would have to be faced of having to winter at Gartok or some equally cold and inhospitable spot; secondly, it was quite impossible to tell whether and to what extent the Tibetans would assist us. Fighting had only lately ceased, the treaty had been signed barely a month previously, and there had been no opportunity of seeing whether the Tibetans would adhere to the treaty when our troops were withdrawn to India.

Our time for preparation was very short, every day's delay increasing the probability of our being snowed up. Captain Wood and Lieut. Bailey arrived at Gyangtse, which was to be our starting-point, on September 30, while Captain Rawling and I only reached the same place on October 6 and 5 respectively.

Our transport we organized as follows: twenty-six baggage ponies to give us a nucleus of our own, should the Tibetans make difficulties about providing us with animals; seventeen riding ponies, it being important that, in view of long and continuous marching at a high elevation, as many men as possible should be mounted; one hundred yaks were lent to us from one of the transport yak corps to take us to Shigatse, but not to go beyond that town. From there onwards, however, the Tibetans invariably, and without any demur, provided us with whatever transport we required. Ponies, donkeys, mules, yaks, and coolies at various times carried our baggage, and, although it was difficult to supervise so large and mixed a caravan, no single article was lost during the whole time the journey lasted.

We took two months' supplies for all our men, with two months' extra of such things as ghi, goor, etc., which could not be obtained *en route*; while for the officers' mess we took four months' stores. Meat we could rely on obtaining in abundance, and tsamba or parched barley flour, as long as we came across villages.

Our party was finally organized and ready to start on October 9 as follows:—

Captain C. G. Rawling, Somersetshire Light Infantry; Captain C. H. D. Ryder, R.E., Survey of India; Captain H. Wood, R.E., Survey of India; Lieut. F. M. Bailey, 32nd Pioneers; Sub-Surveyor Ram Singh, R.S.; hospital assistant Hira Singh; three military surveyors; five sepoys of the 8th Gurkha Rifles; five survey Khalassies; seven pony-drivers; two Hindustani servants; two Tibetan servants; Mahomed Isa, a Ladakhi, who acted as caravan leader; and last, but not least, a very small Lhasa Blenheim spaniel, who followed our fortunes throughout.

In order to have the advantage of the company of Captain O'Connor, who was remaining as trade agent at Gyangtse, and who, with two other officers, was making a trip to Shigatse, we postponed our departure till the 10th.

Our first day's march took us to Dongtse, the late headquarters and supply depôt of the Tibetan army which had attacked the mission and its escort for two long months at Gyangtse; but here, like everywhere else, we were cordially received—mainly, I fancy, owing to our being accompanied by a Lhasa official, who had been deputed to escort us to Gartok, and also to our being supplied with a very strongly worded permit signed with the seals of the Lhasa Government and of the three great Lhasa monasteries, and directing all officials along the route to render every assistance.

Three more marches, following the valley of the Nyang Chu, which is one of the richest and most prosperous valleys of Tibet, landed us at Shigatse on October 14. Here we spent several busy days with an army of tailors, making warm clothing for ourselves and our men, lining all coats with lambskins, making fur caps and gloves, etc., till finally, when fitted out, we presented an appearance akin to Arctic explorers. Our stay at Shigatse was not, however, all work. We paid a most interesting visit to the great Tashi Lhunpo monastery, where the monks received us most cordially, showing us all over the place, and finally giving us refreshments of tea, cakes, and dried fruits. This monastery is said to contain four thousand monks, and although not so large as, is richer than, the great Lhasa monasteries. The bulk of the buildings, the residences of the monks, were of the usual type—narrow paved roads with high houses on each side, dirty, and not picturesque; but we also enjoyed the sight of the tombs of the five previous Tashi lamas, each a separate building with its golden roof and highly ornamented interior, filled with a wealth of turquoises, gold bowls, and rare old jade and cloisonné, the effect being somewhat marred by a foreground of small vessels holding lighted tapers fed by very evil-smelling butter. Bogle's description of his visit is very picturesque and accurate; the number of tombs has now, however, increased from three as seen by him to five as seen by us.

We were fortunate, also, in being received by the Tashi Lama, who, after holding an almost co-equal position to the Dalai Lama, has now, by the deposition of the latter, become the most important ecclesiastic in Tibet. He was living in his summer residence, a house outside the town, to which, with Captain O'Connor as political officer at our head, we proceeded. A little hitch occurred at the gateway, as an archscoundrel, Colonel Ma, who had been the Chinese official at Gyangtse when we were attacked, and had never given us warning, nor even tried to protect the servants and property of his colleague Captain Parr, was also paying a visit. Captain O'Connor refused to enter the house while this individual was in it, and the latter had to be smuggled out by some back door. We were then shown up some steps and along dark passages till we arrived at the reception-room, at the far end of which we could see the Tashi Lama seated cross-legged on cushions on a raised platform. He received us each with a bow and a smile, which we returned, and were shown to seats on one side of the room, while the other side was filled with Tibetan officials and monks in either the ordinary maroon-coloured clothes usually worn

A MAIN STREET IN LHASA.

by monks, or in the yellow silk of the higher temporal officers. Tea, undrinkable as usual, was handed round, but on this occasion it had a certain glamour attached, due to its being served in enormous teapots of gold and silver. Dishes laden with sweetmeats and dried fruits were also brought in, but soon hurriedly removed and handed over to our followers.

While Captain O'Connor was exchanging civilities with the Tashi Lama, we had time to think of the sudden change from a few months before, when the Tibetans, amongst whom was a strong contingent from this very place Shigatse, were attacking us at Gyangtse, to the present moment, when we, a few unarmed officers, were sitting in amity with our quondam enemies. The Tashi Lama himself is an interesting personality; sixth holder of the office, his face is one that would not pass unnoticed anywhere, still less in Tibet. He has clear-cut features, high cheek-bones, and a pale complexion; his quiet, dignified manner made a lasting impression on us. His age is only about twenty-three, and he seemed generally beloved and revered. During the whole of our visit a slight and pleasant smile never left his face. After silk scarves had been presented to us and our Tibetan followers had been blessed, we left, with the feeling, due partly to the personality of the Lama himself, partly to the room with its dim light, that we had been assisting at some religious ceremony.

We had commenced our survey at Dongtse, one march from Gyangtse, and as we wished to keep up triangulation, Captain Wood and I left Shigatse on October 17 to do two short marches, the rest of the party leaving a day later and doing the two marches in one. Owing to bad weather, which gave us some rain and covered the surrounding hills with snow, we were unable to reach our hill, so decided to halt a day at Kangjen Gompa, a most delightful camp in a grove of trees. This was the same storm which entailed such hardships on our force returning to India in the neighbourhood of Phari Dzong. Fortunately for us, we were here at the lowest point of our journey, the height of Shigatse being 12,570 feet, and escaped with only slight inconvenience.

By visiting these hills, one of which was over 18,500 feet in height, and from two of which we had fine views of Mount Everest, Captain Wood was enabled to carry on the triangulation under very adverse circumstances. To climb one of these hills is itself a hard piece of work; to observe at the top in a bitter wind is one of the most physically painful operations I have ever experienced. To do this in combination with a day's march leads to a very long and hard day's work. Captain Wood carried this on for days and months with hardly any intermission—a feat which could only have been accomplished by an officer of his energy and determination.

Until we reached Pindzoling, on October 22, the river had been a few miles to the north of our route, but from thence we followed the river more closely. Two more marches and we were at Lhatse Dzong; a dzong or fort on a small rocky hill, very similar to those at Shigatse and Gyangtse, surrounded on one side by the river and on the others by a fair-sized monastery and a small town. The valley here widens out into a plain, cultivated in parts, barren elsewhere. At Lhatse Dzong we halted a day, which enabled Captain Wood and I to ascend a hill a few miles east of the town, overlooking a broad bare valley which leads to the very famous Sakya monastery. We regretted that want of time, and the consideration that it was not advisable to divide into two parties until we had thoroughly tested the friendly disposition of the Tibetans, had prevented us from paying a visit to this monastery.

From Lhatse, however, the Tibetans having shown no desire but to assist us in every way, we decided to separate. While Captain Wood and Lieut. Bailey followed the main route, which here crosses and leaves the river, Captain Rawling and I stuck to a route reported to follow up the south bank, as I did not wish, if possible, to omit any portion of the river from our survey.

Accordingly, on the 26th we parted company, camping that night on opposite sides of the valley, which now closed in. We kept to the river the following day, but on the 28th we had to leave it, and for two marches followed up a side stream, the Chi Chu, running parallel to and only 2 or 3 miles distant from the Tsangpo, which we again rejoined on the 30th. On November 1 we could see that the river ran between rocky hills with snow-peaks on either side, and had to leave it, making a wide *détour* to the south. We marched up

BIRD'S-EYE VIEW (LOOKING DOWN VALLEY) OF CHI CHU VALLEY FROM HILL ABOVE DABONG. DABONG IN RIGHT-HAND CORNER.

a side nullah, camping in bitter cold at nearly 16,000 feet, and crossing the Kura La, a very desolate pass, next day, at an elevation of 17,900 feet; marching across the head of a plain which forms the headwaters of the Chi Chu, previously mentioned, we passed over an almost imperceptible watershed down a narrow stony valley to the village of Kaju. We had had a magnificent view from a hill a few hundred feet above the pass of the main Himalayan range. Mount Everest stood up towering above the rest of the range in its neighbourhood in one isolated peak, a continuous drop of some 8000 feet separating it from the rest of the range east and west of it. The village of Kaju (14,800 feet) lies on the edge of the Sutso Tang plain, which takes its name from an old ruined fort on a small eminence in its centre. It is here about 5 miles wide, and we could see it trending away southwards and joining the Dingri maidan, which lies north of Mount Everest. A day's halt here enabled me to cross this plain, from the hills on the western side of which I obtained an uninterrupted view of Mount Everest, no hills intervening. I was thus able to satisfactorily establish the fact, which I had suspected a year before at Kampa Dzong, that no peaks anywhere approaching the height of Everest exist to the north of it or anywhere in its neighbourhood; it stands alone in its magnificent solitude, and is entirely disconnected from the mass, to the west of which Peak XX. (Gaurisankar) is the best-known point. On the south-east of Everest, but separated from it by a low gap, lies Peak XIII. (Makalu). We were here in the valley of the western branch of the Arun or Kosi river, but, recrossing the watershed next day by the Sheru La (17,600 feet), we once more reached the banks of the Tsangpo on November 5. The scenery was now changing; trees we had said good-bye to some marches back, our last cultivation we passed that day, while the hills were becoming more open and the plains abounded in sand-dunes. Brushwood was in places available for fuel, but we preferred argol, or dried yak-dung, as it gave greater heat, and, if the fire was carefully looked after, less smoke. During the whole of this portion of the river journey we had seen no four-footed game other than numerous hares, and a few gazelle on the Sutso Tang plain, but birds we saw and shot numbers of, Tibetan partridge, ramchikor, and Tibetan sand-grouse giving us a welcome change in our otherwise monotonous fare of mutton.

On the 6th we crossed to the north bank of the river with the utmost difficulty; a crazy-looking punt, manned by lamas, took us across in detachments, but, owing to the masses of floating ice whirled down the river by the rapid current, the punt was repeatedly forced back, and only reached the opposite shore after floating down some 400 yards, the operation of hauling the boat up again to its original starting-point against the ice being very hard work. On the 9th we arrived at Saka Dzong, a small village, and found that Captain Wood's party had reached there two days previously. We gave ourselves another day's halt here, as there was a good deal of surveying to be done in the neighbourhood.

Captain Wood writes as follows, regarding his journey:—

"Leaving Lhatse on October 26, we crossed the Tsangpo about half a mile below the town. A couple of boats had been collected by the Tibetans for ferrying across our kit and transport, but the process was very much shortened by the discovery of a ford about a quarter of a mile up-stream, by which the ponies were able to cross. After keeping to the north bank for about 10 miles, we turned up a side nullah and camped at Sanggelung village; following this nullah next day for a short distance, we crossed by an easy pass into a country the drainage of which led into a succession of small lakes, whose surfaces were covered with geese and duck. On the largest of these, the Ngap-ring Tso, a tasam, or stage-house, is situated, which place we reached on the 27th; and, hearing that no grain would be procurable until we reached Barkha, on the Mansarowar lake, we bought all we could procure, but even this would only give our ponies a couple of pounds daily. The next day we passed Ralung, the last place we saw cultivation. Every day now found us at a higher altitude, as we were marching more or less along the watershed between the Tsangpo and its large tributary, the Raga Tsangpo. The valley of this latter stream is narrow, running almost due east and west, parallel to and about 30 miles to the north of the main river. Into this distance is crammed a tangled mass of hills, whose crests average about 18,500 feet, with several peaks of about 22,000 feet, covered with permanent snow. This part of our march was exceptionally unpleasant, as the wind on the hills never dropped by day below hurricane force, and, camping at elevations up to 16,100 feet, the change in temperature from the comparatively warm valley of the Tsangpo was most noticeable. The hills, clothed with a coarse grass on their lower slopes, but quite bare above 17,000 feet, were, as a rule, easy to climb; and from the summits lovely views of the Himalayas were obtained, Makalu and Everest, both standing out as great isolated peaks, being particularly imposing. The tasams, at which every four or five days we changed our yaks for fresh ones, were the only signs of habitations we met with, and these, as a rule, consisted of tents, with a mud hut or two. The marches were all long and wearisome in their monotony, and, owing to the narrowness of the

TOMB OF ONE OF THE TASHI LAMAS. TASHI LHUMPO MONASTERY.

valley, Ram Singh and I, to carry on the survey, had to climb to the crests of the range every day, seldom getting into camp before sunset, and on one or two occasions not arriving before nine or ten at night. On November 5 we crossed the Ku La (16,700 feet), situated at the headwaters of the Raga Tsangpo, and by a steep descent dropped into the valley of a small stream draining into the Tsangpo. At that night's camp we received letters from Captain Ryder, saying that he would arrive at Saka Dzong on the 9th. Passing under the snowy range of Chour Dzong, whose peaks range up to 21,000 feet, we reached Saka Dzong on November 7."

During our halt at Saka Dzong, Captain Wood ascended a high peak to the north (19,300 feet), from which he had a fine view north up the valley of the Chata Tsangpo, a tributary of the main river.

Saka Dzong has only a dozen or so houses, very dirty, the neighbourhood (height 15,150 feet) being, like that of every Tibetan village, a dust and refuse heap. We left on November 11, again in two parties. This time Lieut. Bailey accompanied me back to the river, while Captains Rawling and Wood followed the main route. That day we forded the Charta Tsangpo, a fair-sized affluent of the main river, and, crossing some low hills, reached the Tsangpo on the 12th, crossing the same evening late, it being necessary to do so then, as from my previous experience I knew that the river would be nearly impassable in the morning from floating ice. We crossed in a small skin-boat, our animals fording higher up. For several days we marched up-stream in a broad valley covered with low sand-dunes and stones, with a very small quantity of poor-looking grass, on which, however, kyang and gazelle seemed to thrive. The track followed by the Pandit Nain Singh, as he marched up from Nepal to Tradom in 1865, joined in on our left, but in these plains in Tibet it is difficult to find any signs of a path, as every caravan meanders over the plain without keeping to any defined track.

We recrossed the river on the 16th; but now it was completely frozen over, and we crossed on the ice, the only thing necessary being to make a good track for the animals by throwing some earth down on the ice. That evening we arrived at Tradom, where we found the rest of the party had arrived on the 14th. The weather had been taking a turn for the worse: low temperatures at night we always had, cold winds in the day were the rule; but if the days were sunny, a little walking would soon make us warm. When the days were cloudy, however, there was nothing to counteract the cold, and a march was a most miserable performance.

Captain Wood writes: "On leaving Saka Dzong, our party kept down the valley till we reached the Chata Tsangpo, which we found no difficulty in crossing. The stream was at that time some 100 feet in width, with a depth of 2 feet, flowing in one channel, having just left a very deep narrow valley to emerge into a plain of about 3 miles in width. Striking up a small side nullah, we followed it for 5 miles, and camped at the foot of the Lalung La. On this pass we first saw signs of *Ovis Ammon*, and from the information we received, this appears to be the eastern limit of their country along the road we had traversed. The road for the next three days—if it can be called a road—was the worst we met with, and consisted of large broken rocks set in deep sand; and to make us even more uncomfortable, the weather changed to snow, accompanied, as usual, by a howling gale of wind. Inhospitable as Tradom appeared to us when we first descried it, we hurried on as fast as our ponies would take us, to get within the shelter of its single stone house, where we might warm our frozen limbs over a yak-dung fire, and pity the remainder of our party, who had still another two days to endure before they could hope to join us."

Tradom did not tempt us to halt; it is a desolate spot, with a small monastery on the hill above, inhabited by only three or four monks, but from the hills to the north we had a fine view of a snowy range reaching an elevation of 23,200 feet. We accordingly left the next day, and, marching across the plain all day, camped amongst the hills on the far side. This plain is full of small ponds lying among sand-dunes, and there was an unpleasant tributary or two to cross, the water frozen at the edges for 4 or 5 yards, then a drop of 3 feet into icy-cold water full of floating ice, ending with a scramble out on the other side on to ice again.

We now followed the river valley for a week or so, always in the same large plains, until we could see the watershed range ahead of us, from the valleys of which innumerable streams issue to form the Tsangpo, the largest coming from a snowy range to the south-west. After enjoying some days of bright sunshine, the weather again took a turn for the worse, and we crossed the Mayum La (height 16,900 feet) on November 26, with a foot or two of snow on the ground. We had now finished with the Tsangpo, having surveyed it from Shigatse to its source. Our next point of interest was to be the lake region ahead of us. The day after crossing the Mayum La we camped on the northern shore of the Gunchu Tso, a lake 11 miles long by 2 or 3 miles broad, with an area of 22 square miles, completely frozen over, and having no outlet at all. Several *Ovis Hodgsonii* (*ammon*) had been shot before reaching the Mayum La, and we now came on large herds of Tibetan antelope, of whom we each shot several, and could have shot many more if we had wished, as they were very tame.

Crossing several low passes and generally undulating ground, we came in sight of the Mansarowar lake (Tibetan Tso Mobang) on November 30. The lake is neither impressive nor beautiful, like, say, the Yamdrok Tso, passed on the way to Lhasa. It was not frozen over, except for 100 yards or so round the edge; the water was fresh, and our surveyor, Ram Singh, on account of its sanctity, bottled some and carried it back with him to his home in Dehra Dun. Skirting the lake, we rode across the low hills, which close in on the western side, to look for the outlet, which Moorcroft had not been able to find, which Strachey had found, and which Mr. Savage Landor had claimed to have proved did not exist. We struck the channel a mile below the outlet, a small stream only partly frozen over; this we followed up, and found that it did not flow from the lake, but from a hot spring, at which we found and shot some mallard. We then followed up the dry nullah to the lake, and proved that Strachey was, as was to be expected, quite correct. No water was flowing at this time of year, but the local Tibetans all agreed that for some months in each year there was a flow during the rainy season and the melting of the snows, *i.e.* about from June to September. As a rise of about 2 feet in the level of the lake would cause water to flow down the channel, this appears quite worthy of belief. The length of the channel between the two lakes is about 3 miles. That day, December 2, we reached a Tibetan stage-house, and next day had a long day's ride to try and discover an outlet for the second lake, the Rakas Tal, or Tibetan Lagang Tso. This lake is very dissimilar to the Mansarowar in shape, and was entirely frozen over. The latter is about the same width, 12 miles north and south, as it is east and west, with an area of 110 square miles; the former is a long narrow lake running north and south, some 16 miles long by 3 or 4 miles wide, with an area of about 55 square miles.

It is the sacred character of the Mansarowar lake rather than its size which has made it well known; its height above sea-level is 14,900 feet. We found an old stream-bed issuing from the Rakas Tal, but every Tibetan we asked told the same story—that no water ever flowed along it now, but that in days gone by, one man saying before the Sikh war, water did flow out of the lake and down this channel. We followed it down for some 6 miles along the plain, and could find none of the ordinary signs that water flowed down it until we reached some low hills; here evidently, from the lie of the sand, water flowed at some time of the year, and away from the lake. The lakes being now entirely disconnected at all times of the year from the Sutlej river, the sources of that river must lie in the hills on either side of the valley and west of the lake region.

The Kailas peak was very prominent on the hills to the north, snow-covered, 21,800 feet in height. The strata forming the mountain are horizontal, which gives it a peculiar appearance; from the side we saw it, the top was quite inaccessible. There are several monasteries on the path which pilgrims follow in circumambulating the mountain. A very fine snow-mass, culminating in a peak over 25,000 in height, Mémo or Gurla Mandhata lies to the south of the Mansarowar

MANSAROWAR LAKE.

CHANNEL CONNECTING THE MANSAROWAR WITH THE RAKAS TAL LAKE.

lake. A low watershed south-west of the lake leads to Purang or Takla Kot.

Keeping to the north side of the broad open valley in which the Sutlej flows, we arrived at another stage, Menzé or Missar, on December 5. Here we divided, sending our heavy baggage down the valley with Ram Singh, as I wanted him to continue the survey of the Sutlej valley while we went into Gartok. We were pleasantly surprised to find the Jerko La, the pass on the Sutlej-Indus watershed, low and easy (height 16,200 feet), and without difficulty reached Gartok (height 15,100 feet) on the 9th. This is the summer residence, Garyarsa; the two Garpons, the joint governors of Western Tibet, were

LHATSE DZONG, THE LAST LARGE VILLAGE EN ROUTE FROM SHIGATSE TO GARTOK.

residing at Gargunsa, the winter residence, some 30 miles down the valley, but had come up to receive us.

We only halted one day at Gartok; in that time we had seen more than enough of it. We were unanimous in looking on it as one of the most dreary inhabited places we had struck in our journey—a long broad plain, absolutely bare, with a dozen wretched hovels in the middle, constitutes at this time of year what is in summer the chief trading centre of Western Tibet; but in summer traders are said to collect in large numbers, living in tents. The wind howled round the hut we were in continuously, and, the weather looking threatening, we were not anxious to stay a minute longer than was necessary for Captain Rawling to settle up trade questions with the Garpons. Having now accomplished the main object of our journey, it only remained for us to get back into India as soon as possible. Fortune had favoured us so far, but we had some high passes to cross. The first of these was the Ayi La, height 18,700 feet. Two marches took us to near the top of the pass, encountering a blizzard the second day. That evening we saw the only herd of wild yak we had come across in our journey. Crossing the pass next day was no easy matter; the ascent was gradual, but there were 2 feet of snow on the ground, and a bitterly cold wind was blowing. It was with the utmost difficulty that, under some shelter from a rock, I took boiling-point observations, and with a sigh of relief hurried down the other side. One of our chief obstacles was surmounted. It began snowing on the pass that evening, so we had only just crossed in the nick of time. At Dunkar (14,100 feet), where we camped that night, we met cultivation for the first time, and it was a pleasant sensation to feel that we were gradually coming to the end of high altitudes.

From here Captain Rawling and Lieut. Bailey next day marched to Totling (Tibetan Tuling), on the Sutlej, where they met Ram Singh's party. Captain Wood and I halted a day at Dunkar, and marched next day to Tibu, where the whole party was once more united. We were now in the most cut-up country I have ever seen; it must resemble the loess formation of China. The bottom of every nullah was some hundreds of feet below the general level of the valley, with their edges so cut and worn into fantastic shapes that it was difficult to believe that one was not looking on the ruins of old castles. There are also innumerable caves, in which the inhabitants live.

On December 16, at Kyinipuk, we met Thakur Jai Chand, who had been sent up to be our trade agent at Gartok. He brought with him some very welcome newspapers. I must own we none of us envied him his job for the winter.

Each day's march now consisted of climbing up out of a deep nullah and down again into the next. We crossed the Shiring La (16,400 feet) on the 21st, in deep snow, with great difficulty, the descent on the western side being very bad going. Next day we camped at Tyak, on the Sutlej, which had been flowing on the left of our route only a few miles distant, but invisible to us owing to its being at the bottom of a deep gorge. On the 23rd we marched to Shipki, crossing the river on the ice, elevation 9300 feet. On Christmas Eve we surmounted our last obstacle, the Shipki La on the frontier—a climb of 5000 feet, mostly in snow, and a drop of 6000 feet on the other side, camping at Khab, in British territory. From here we had eighteen marches into Simla, finding bungalows at every stage on and after December 28, finally arriving at Simla on January 11.

The area we surveyed with the plane-table comes to about 40,000 square miles. We surveyed the Tsangpo from Shigatse to its source, surveyed the Mansarowar lake region, and settled the doubtful points connected with it, which have been the subject of much discussion; we completed the survey of the Sutlej river from its source to where it enters British territory, and surveyed the source of the Gartok branch of the Indus.

The triangulation, which is still under computation, was invaluable to correcting the plane-table work and fixing many heights.

The cold we had to contend against was at times very severe; the lowest minimum we recorded was $-24°$ Fahr., but as the thermometer always registers its lowest on clear, still nights, it is not a good guide. It may be generally said that when the air was still the cold was quite endurable, and on sunny days, out of the wind, no climate could have been pleasanter. When, however, the wind blew, which, I am sorry to say, was generally the case, no clothing ever invented was sufficient to keep one warm. When a hurricane occurred on a cloudy day, our surveying was done with lightning rapidity, our great object being to hurry on to the friendly shelter afforded us by our tents; but the constant change of scenery, and the interest of our journey, did much to counteract the discomforts we met with.

My companions will agree with me that the success attending our journey was in the first place due to the friendly attitude of the Tibetans, induced by the cordial relations which Sir Frank Younghusband had established with the Lhasa Government. We were indeed glad to be able, by only two or three months' hard work on our part, to prove that the treaty signed at Lhasa was not merely a paper one, as might so easily have been the case, but that it inaugurated an era of truly friendly relations between ourselves and the Tibetans.

I am greatly indebted to my companions, Captain Rawling and Lieut. Bailey, for the ready assistance and hard work they underwent in furthering the survey work, in which Captain Wood and our native surveyor, Ram Singh, proved themselves sterling workers.

NOTE.—The lecture was illustrated by lantern slides from photographs taken by Mr. J. C. White, Mr. H. H. Hayden, Captain C. G. Rawling, and the lecturer.

Before the paper, the PRESIDENT said: We have to welcome this evening Major Ryder, on his return from a most important and interesting journey in Tibet. I need not introduce Major Ryder to the meeting, because he is an old friend, and most of you will remember the interesting paper he read a little more than three years ago on the subject of his survey with Major Davis in Yunnan. I call upon Major Ryder to read his paper.

After the paper, Sir FRANK YOUNGHUSBAND: Major Ryder has very gracefully acknowledged that the success of his expedition was due to the friendly relations which I, and he might have added which General Macdonald and every officer and man in the force, was able to establish with the Tibetans, and that is all the more satisfactory because it was no part of the treaty that this expedition should take place from Shigatse to Gartok. It is, however, only a contributory factor to the success of the expedition, and the expedition would never have taken place at all if the idea had not originated in the fertile brain of Mr. Louis Dane, the Secretary of the Government of India, in the Foreign Department. He it was who first put this idea into my head, and after I had thought it over and considered the *pros* and *cons*, I put it to the Tibetan Government, and was able to obtain from them consent for it to be undertaken. However, even then, with the idea originated and with the approval of the Tibetan Government, little would have come of it if we had not been able to obtain the services of really efficient agents, and, fortunately for us as a nation, we can always lay our hands upon almost any number—certainly in Tibet there were dozens of men who have, not merely physical energy, nor merely animal courage, nor merely professional zeal, but, in addition to all these, that good heartedness and a capacity for getting on with all kinds of people, and tactfulness, which enables them to carry an expedition to countries which, but for this tactfulness, it would be impossible to penetrate at all. Among such men was Major Ryder, who on a previous occasion had travelled for two years in Western China, and had, in the service of the Government of India, surveyed in Burma and in many other places upon the Indian frontier. He had lived with me for many months in Tibet, and I had there seen and been able to test his great industry and his capacity for surveying, and his thorough zeal in whatever he undertook, whether it was the management of the mess, or, as he had to do at this time last year, organize the defences of a post as we had to at Gyangtse in the face of the enemy. An equally good man was Captain Rawling, who had, in the year previously, made an excellent expedition into Western Tibet, and had there by his tact been able to get himself out of some exceedingly nasty positions in which he found himself at a time when the Tibetans were not altogether friendly with us. Captain Wood and Lieut. Bailey were similar men, and it was due to their tactfulness that this expedition has been able to get through successfully and leave a good disposition behind them which will enable future travellers to fill in, I hope, a great deal that is still left to be done. It was due to their tactfulness that they were able to get this expedition through. I need not, however, say that sending this expedition caused all those who had originated it a great deal of anxiety, for we were close on to winter. As soon as negotiations were far enough advanced for me to be able to put the matter before the Tibetans I had done so; that was well on to September, and after that the approval of the Government of India had to be obtained, and the time was passing by till it was on the verge of winter when the expedition set out. This was one cause of anxiety. Another cause was that, just as the troops were being withdrawn from Tibet, it could hardly have been taken as the precise moment in which to launch an expedition 800 or 1000 miles into the unknown. It was, however, with immense relief that we heard of the safe arrival of this party in India. They had gone all the way from Lhasa either on foot or on ponies, they had surveyed the whole way under the difficulties so well illustrated in Major Ryder's lecture and in his slides, and they had come out successfully. This would have been a magnificent performance if it had been undertaken in the very best of weather, and at a time when we could count upon the absolute friendliness of the Tibetans; but that it was done at the very worst season of the year, and at a time when we could only hope for, but feel no assurance in, the friendly disposition of the inhabitants, I think shows that Major Ryder and his companions have done a work which has most thoroughly earned for him the highest honour of the Royal Geographical Society, which we are all very glad to hear has now been awarded him. I only hope that no less award will some day come to his leader, Captain Rawling. We must all congratulate Major Ryder and his companions most warmly on the success which has attended their efforts, and I am sure at the conclusion of this meeting we shall all join in thanking him for the very valuable paper he has read to us, and for the very striking photographs he has been able to put upon the screen.

Brigadier-General Sir Ronald MacDonald: I am afraid I have very little to add to what Sir Frank Younghusband has already said. I can only say I do not think that Major Ryder in any way exaggerated, in fact he did not quite sufficiently draw attention to, the dangers that he had to face on this expedition. Sir Frank Younghusband has referred to the fact that the treaty had only lately been made, and although he had been very successful in leaving behind a feeling of respect, and I might almost say admiration, for our justice and methods, and had shown even the dawn of friendship with Tibet, yet it was a very big risk to take with a small body of officers with practically no escort, to trust themselves to the Tibetans on a journey of this length. I think I may almost say the dangers of the winter were in no wise exaggerated. During the present winter we had three times the snow on the pass that we experienced during the expedition, and there can be no doubt that had Major Ryder's party been a little later, he would have had to winter at Gartok instead of being here. I can speak myself on the work he did. At first the work was with the mission under Colonel Younghusband, and I have no knowledge of his work while he was at Kampa Dzong; but when the survey was transferred to the force I had the honour to command, I can testify to Major Ryder's zeal in his geographical work, and to the loyalty with which he carried out the necessary plans and subsidiary work which were essential from a military point of view. As regards his work at Gyangtse when the mission was beleaguered there, every one who has seen it has admitted that it was high-class field engineering, and there is no doubt that what he did in the way of defending the post added greatly to the comfort of those who had to undergo the unpleasant experience of sitting there waiting. While we were at Lhasa I am afraid I had somewhat to curtail some of Major Ryder's more ambitious schemes for extending his survey. But circumstances would not admit of that; but even so, I think that when all the results are compiled they will show that he has a very solid mass of work behind him which will add largely to our knowledge of a little-known country, and I cordially agree with Sir Frank Younghusband that Major Ryder is a credit to the corps of Royal Engineers, and thoroughly deserves all the honour which the Royal Geographical Society can show him.

Colonel Gore: As the person responsible for selecting Major Ryder to go on this mission, it has given me great gratification to hear of the splendid success which has attended the work of the survey. Major Ryder has given us a very modest account of what is, I think, the most wonderful bit of surveying that I can call to mind. Nobody but a surveyor who has taken part in that sort of work, and under those difficulties, can thoroughly realize what it means to carry on a continuous running triangulation in a mountainous country of that nature and under those climatic conditions. The day is always too short for the work to be done; the cold is such that the fingers get numbed and refuse to do their work, and one's moustache, if one incautiously bends low enough to touch the instrument, freezes on to the theodolite instantly. The problem of surveying in Tibet has always been a very difficult one for us in India. For mapping the greater and more important part of the country, we have had to depend on the work of native explorers sent in disguise, and this expedition has been particularly interesting to us, as it has given us the first opportunity we have had of testing the work done by these native explorers, and I am greatly pleased to hear of the accuracy of so much of their work. For many years no European or native of India proper has been allowed to enter those parts of the country, and so we have had to try and get natives from the borders of Tibet who can talk the Tibetan language, and were sufficiently Tibetan-like in appearance to be able to penetrate the country, and then teach them sufficient rough surveying for our purpose. The Tibetans, however, have always looked with great suspicion on such men, and even so regard those border merchants who habitually cross into Tibet for trade purposes. Our trouble has always been to get border men who have sufficient intelligence to pick up enough surveying to do any good. I thought at one time of attaching these men to regular survey parties for a while, so that they might learn something of real topographical surveying in order that they might carry out their exploration work more intelligently, but I found that a course of survey work so smartened them up and made them so clean that there was no chance of mistaking them for Tibetans. We used to teach them to use a small hand-compass, which they could conceal in the palm of their hand, and they paced their distances, and the more experienced of them could take a latitude with a small sextant. Though, properly speaking, they could not map, they kept a field-book in which they recorded their observations, and a note-book in which they jotted down what sort of things occurred to them; but the sort of things that occurred to them would never occur to a man who wanted to make a map. It was all very well when you had an honest man, because he would do his best, and when he came to a difficulty he would own up and tell you of it, and then you made the best of it. But for the few that the Geographical Society knows of, there have been many who have been hopeless failures. I remember a man who went across the frontier who had had a large amount of training. He came back nine or ten months afterwards, and we were delighted to get hold of his field-books, and we started to see what we could make of them. The first thing that struck me was that they were a great deal too clean; they were nicely drawn out with headings and columns and so on, and it looked rather suspicious. He declared they were his originals, and so we went on and made the best of them. His work, however, did not fit in well, and it was out a good bit, and his latitudes would not fit in with the other work. And then I examined his field-book more closely, and I found he had got all his bearings down in the first column very nicely, but they had been put in as an old-fashioned seaman would put them in, in points. The second column was prismatic compass bearings, but a glance at them showed they were simply obtained by multiplying each of his double points by $22\frac{1}{2}°$, and that man swore he had taken them with the prismatic compass. His uncle was an old and honoured explorer, and what I am afraid was the case was that when he came back from his trip he went to his uncle's house, and between them they made up a new field-book. The work went the way of a good deal more: it found its way into the waste-paper basket—at least, it is lying in the office unused. Another man went round the great bend of the San-po, where that river turns south towards India, and penetrated southwards to the limit of the Tibetan country. He was then caught by the Tibetans and taken back through the lower part of Tibet bordering on Bhutan, and then set free. He brought back his work, but it proved to be useless and was not utilized, so that part of the course of the river is still a matter of some uncertainty. I think that Major Ryder and Captain Rawling have done a very wonderful survey, and they deserve every honour that can be conferred upon them.

Mr. DOUGLAS FRESHFIELD: I shall not detain the meeting this evening more than two minutes. There are certain remarks I might have made on the printed paper, but they are more the remarks of a geographer than those of a traveller, and they would refer to technical points which I think it would be unsuitable to bring forward in this meeting. I will only congratulate Major Ryder on having done one thing which will be very welcome to all mountaineers, and still more welcome to all schoolboys, as that is proved there is not to be a new highest mountain in the world—that the one which we have believed hitherto to be the highest still remains the highest. I would like to warn him of one thing. He spoke of it as "Everest." I hope the word "Mount" will not be habitually left out, and I will tell you the reason why. A misguided friend of mine, a Fellow of the Royal Geographical Society, went to the backwoods of North America and discovered some new peaks among the Rocky mountains, one of which he called Mount Freshfield. He went back again next year, and found it easy to climb, and then he wrote "Freshfield has proved somewhat of an impostor." I hope this may never happen to Colonel Everest.

The PRESIDENT: Captain Rawling and Captain Wood are present, but I will not call upon them. We know what splendid work they both did, and we have seen their photographs, hard at work on the top of very breezy rocks. The Council, I am sure, will be as glad as I am to find that our opinion has been so fully corroborated by Sir Frank Younghusband, Sir Ronald MacDonald, and Colonel Gore, regarding the merits of Major Ryder and as it will be my duty this day week to express the Council's feelings on that subject, I need say no more now. But before closing the meeting, I cannot help saying how pleased I am to find that our Gold Medallist Nain Singh, and the other pundits sent by General Walker and Colonel Montgomerie forty years ago, were as accurate in their observations as they were courageous and loyal to their employers. I will now ask the meeting to pass a cordial vote of thanks to Major Ryder for the admirable paper he has read to us, and for the illustrations he has shown us.

ON THE NILE FLOOD AND ITS VARIATION.*

By Captain H. G. LYONS, F.R.G.S., F.G.S., Director-General Survey Department, Egypt.

Nile Gauge Records.—The data available for a discussion of the Nile floods are not inconsiderable, but the greater part of them are, unfortunately, of very unequal value on account of the irregularity of the readings at the Roda nilometer,† and of the falsification of its records, which is stated to have taken place in earlier times in order to increase the revenue. They may be summarized as follows:—

1. Readings of the Roda nilometer from 700 A.D. to 1903, but the readings for many years are missing.
2. Readings of the Nile gauge at the Delta Barrage from 1846 to 1878.
3. Readings of the Nile gauge at Aswan from 1869 to the present time.
4. Readings of the Nile gauge at Wadi Halfa from January, 1890, to the present time.
5. Readings of the Khartum Nile gauge from 1869 to 1883, and from 1900 to the present time.

The Aswan series of gauge-readings is the most complete, and will be used as the basis of this discussion. At the present time it may be considered that the Aswan dam, though its open sluices admit as free a

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* Continued from p. 272. Diagrams, p. 368. † At Cairo

passage of the flood-waters as possible, affects the old gauge, which is some 5 kilometres down-stream of it, and renders comparisons between readings at the present and those previous to 1901 unsatisfactory; but the gauge at Wadi Halfa has been in existence since 1890, and can therefore be used to confirm and complete the Aswan records.

The Aswan and Halfa gauges have a great advantage over those situated lower down the river, in that the whole flood of the river must pass in the river-channel at these points. Lower down the valley the flood-level of the river rises above the level of the country, and in years of high flood the embankments which should retain the waters in their bed may be breached; thus a lower gauge-reading will be recorded in the vicinity than if the whole flood has been confined to the river-channel. Also the normal flooding of the cultivated lands above Cairo takes a large amount of water from the river at the time of highest flood, so that the maximum range of the flood is not as high in the years when the Roda or Delta Barrage gauges have to be used as if only Aswan or Wadi Halfa readings could be employed. Since, however, the Aswan readings are available from 1869 only, it is necessary to employ those of the Roda gauge at Cairo from 1825 to 1870; before this there is a period of twenty-four years for which there are no records.

The Roda gauge, from its long series of observations, would be of inestimable value if its records were trustworthy, but, unfortunately, this has not always been the case.* For many years past, at least for two centuries, the sheikh of the nilometer has been in the habit of recording the height of the Nile by marks on the wall, and by the steps of the well in which the nilometer column is erected, instead of by the scale of cubits which is cut on the column. The cubits which are used by him are on the average 0·54 metre in length from the first to the sixteenth cubit inclusive, 0·27 metre from the seventeenth to the twenty-second cubit inclusive, and 0·54 metre for the twenty-third and all higher cubits.

The values given by Chélu † and by Willcocks ‡ for the lengths of the cubits differ slightly. Cubits 14, 15, and 16 have been given by the latter as 0·48 metre to 0·49 metre only. However, the method of observation was certainly not one of great accuracy, and no considerable error will be introduced into the discussion of the yearly maxima if the values given by Willcocks are taken as being correct.

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* See also 'Description de l'Egypte,' vol. 18 (Paris: 1825); Manoug, 'Données utiles sur la crue du Nil' (Alexandrie: 1882); Ardagh, *Proc. R.G.S.*, 1889, p. 28; Manoug, *Proc. R.G.S.*, 1889, p. 245.

† 'Le Nil, le Soudan et l'Egypte,' pp. 84 and 87 (Paris: 1891); but the values on these two pages do not agree.

‡ 'Egyptian Irrigation,' App. V. p. 472. London: 1899.

Unfortunately, no original documents earlier than 1873 A.D. now exist in the Ministry of Public Works, Cairo, by which these readings may be verified. The series published by Ali Pasha Mubarik,* which is supposed to have been taken from original documents, is given for Mohammedan years, and when the beginning of a year, the 1st Moharrem, falls near the date when the Nile is highest, there is some doubt to which year the recorded maximum belongs, as no day of the month is mentioned. From 1846 to 1878, however, there is a series of readings at the Delta Barrage, 25 kilometres down-stream of the Roda gauge, which serves as a control. It will then be best to take the maximum readings as given by Tissot,† where the date of the maximum reading recorded is given for each year.‡ There is another series from 1737 A.D. to 1800, which appears to have been recorded under similar conditions, the range being much the same; and when the readings are converted to metres in the same way as those from 1825 to 1872, the mean maximum is 7·02 metres for the former as compared with 7·17 metres for the latter.

The Delta Barrage § records are less ambiguous. They extend from 1846 to 1872, and were kept daily for the whole year, and not for the flood only. No originals of these apparently exist in Egypt now, but the maxima are given in 'Statistique Générale de l'Egypt,' ‖ and copies of all the observations were sent by Stone Pasha in 1880 to Colonel Donnelly, by whom they were given to the Science and Art Department, London,¶ but these cannot now be traced. On the whole, these two sets of readings agree fairly well (Table XII.), and the mean difference between them is 0·30 metre, which is not very far from the difference obtained by using the flood-slope of 1 : 10, 300, and a distance of 25 kilometres, *i.e.* 0·26 metre.**

* 'El Khitat el Taufikia el Gedida li Misr el Kahira,' chap. xviii. Cairo: 1306 A.H.

† 'Statistique de l'Egypte.' Cairo: 1883.

‡ It should be mentioned that the original observations were made according to the Coptic (Julian) calendar, and Ali Pasha Mubarik has converted them into the corresponding Mohammedan years. Here, however, an error has crept in. No Nile maximum occurred in the year 1270 of the Hegira, one falling at the end of 1269 A.H., and the next at the beginning of 1271 A.H., though he has recorded that for 1271 A.H., as if it belonged to the year 1270 A.H., and so on. Thus all the Nile floods from 1854 to 1862 are given a year too early; but by recording the flood of 1862 to both 1278 A.H. and 1279 A.H., the years after this have been made correct.

§ A point 25 kilometres below the Roda Nile gauge, where the Rosetta and Damiette branches diverge, the real apex of the Delta.

‖ Cairo: 1879. Also see Fritz, in *Meteorologische Zeitschrift*, 1880, p. 303.

¶ *Nature*, vol. 25, p. 269, January 19, 1882.

** Willcocks, 'Egyptian Irrigation,' plate ii. London: 1900.

TABLE XII.

Year.	Maximum reading.		Difference.
	Roda gauge.	Barrage gauge.	
	metres.	metres.	metre.
1846	7·55	7·24	−0·31
1847	7·10	6·48	−0·62
1848	7·70	7·53	−0·17
1849	7·68	7·35	−0·33
1850	6·46	6·13	−0·33
1851	7·77	7·38	−0·39
1852	6·35	6·01	−0·34
1853	7·77	7·76	−0·01
1854	7·55	7·50	−0·05
1855	6·20	5·94	−0·26
1856	7·75	7·46	−0·29
1857	6·48	6·09	−0·39
1858	6·40	6·07	−0·33
1859	6·32	5·90	−0·42
1860	7·67	7·27	−0·40
1861	7·90	7·73	−0·17
1862	7·04	6·65	−0·39
1863	8·11	7·73	−0·38
1864	5·95	5·80	−0·15
1865	7·02	6·52	−0·50
1866	8·31	7·76	−0·55
1867	6·46	6·38	−0·08
1868	5·87	5·83	−0·04
1869	8·40	7·85	−0·55
1870	7·92	7·50	−0·42
1871	7·38	7·48	+0·10
1872	7·65	7·32	−0·33
		Roda Barrage=0·30	

The daily readings of this gauge for 1846–7–8–9 are given by Jomard and Malte-Brun,* and 5-day means for 1846–1861 have been published by d'Arnaud.†

In about seven or eight years the differences are irregular, due perhaps, in some cases, to breaching of banks, perhaps to incorrect records, but in three cases the years are those of exceptionally high floods, and thus the 20 or 30 centimetres will not affect the argument. Generally, then, it may be said that as far back as 1846 the data are sufficiently reliable. If, then, the Roda gauge records are so far reliable, it would seem that the others from 1827 to 1845 might also be accepted, though at this time there is no other gauge to confirm them. It happens, however, that from 1827 to 1839 the floods of 1829 and 1834 alone exceed the mean of the maximum readings 1827–1872, and therefore confirmatory evidence that twelve of these years were abnormally low is very desirable. That in 1829 the flood was an exceptionally high one is mentioned by Barker ‡ in a letter dated September 1, 1829.

* *Bull. Soc. Géog. Paris*, April, 1864.

† 'Mémoires de l'Institut Egyptien,' t. 1, p. 115. Paris: 1861. Also *Zeitschr. f. Allg. Erdkunde*, Bd. 14.

‡ 'Syria and Egypt under the Last Five Sultans of Turkey,' vol. 11, p. 110. London: 1876.

Curzon * mentions that in 1833 the flood was feeble and late, so that on August 28 9 feet more were needed to ensure an average crop. The years 1836 and 1837 were very low, especially the latter, and this is recorded by Holroyd, † who says, "the rise of the Nile this year (1837) is less than it has for been five or six years past;" and also by Bowring.‡ Russegger also mentions that the Blue Nile had already fallen at Khartum 2 feet on August 20, 1837, though it rose again on August 30.§

Lefébvre says that of the five years 1839–1843, during which he was in Abyssinia, two had excessive rainfall, while three were deficient.‖ These would correspond with the high floods of 1840, 1841, and 1842, and the low ones of 1839 and 1843, so the numbers of dry and wet seasons seem to be misplaced.

Thus we may accept the Roda gauge-readings as sufficiently accurate for investigating the question of the yearly variation of the Nile flood.

The Aswan gauge was established by Mahmud Pasha el Felaki in 1869, on the island of Elephantine, in the same covered stairway as the ancient Egyptian nilometer, but on the other wall face. For this daily readings are available from June 19, 1869, to the present date, except during an interval from November 13, 1869, to March 1, 1870, during which no readings were recorded; the scale is in piks and qirats; 1 pik = 24 qirats = 0·540 metre.

The gauge at Wadi Halfa was built in 1890, and daily readings exist from the beginning of January, 1890, to the present time.

At Berber a gauge was erected, and the reading was recorded daily during the flood for the years 1880–1–2–3.

Year.	From.	To.
1880	June 10	September 26
1881	,, 10	October 9
1882	,, 11	,, 9
1883	,, 11	,, 9

In 1900 a new gauge was erected here, but no connection between the old and the new series of readings could be established.

The old Khartum gauge was erected in 1864,¶ when Musa Pasha was governor of the Sudan, and the daily readings were taken from the first commencement of the rise till the flood was past. It is not known whether these began in 1865, but the only series of daily gauge-

* 'Visits to the Monasteries in the Levant,' p. 27. London: 1850.
† 'Egypt and Mohamed Ali Pasha in 1837,' p. 28. London: 1838.
‡ 'A Report on Egypt and Candia,' p. 14. London: 1840.
§ 'Reisen in Europa, Asien und Afrika,' vol. 4, p. 413. Stuttgart: 1844.
‖ 'Voyage en Abyssinie,' vol. 3, p. 10. Paris: 1840.
¶ *Pet. Mitt.*, 1864, p. 308.

readings at Khartum which now exists is from 1869 to 1883; these were taken daily from about the middle of May till the end of October, or the early part of November.

	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.
From ...	May 19	May 19	May 17	May 8	May 11	May 8	May 8	May 8
To ...	Nov. 9	Oct. 29	Sept. 28	Oct. 2	Sept. 24	Nov. 9	Nov. 9	Nov. 9

	1877.	1878.	1879.	1880.	1881.	1882.	1883.
From ...	May 10	May 10	May 10	May 10	May 8	May 19	May 19
To ...	Oct. 15	Oct. 29	Oct. 29	Oct. 29	Oct. 29	Oct. 29	Oct. 29

These were interrupted by the Mahdist revolt, and were not resumed until 1900, from which date they have been recorded daily throughout the year up to the present time. It has not been possible to determine the site of the old gauge of 1869–83 with sufficient accuracy to refer the readings of the present gauge to it.

Therefore, by utilizing the Roda gauge-readings from 1825 to 1872, and the Aswan gauge readings from 1871 to 1902, and the Wadi Halfa gauge for any subsequent years, we have a series of maximum readings of the Nile flood for 80 years, which are very fairly accurate, since for almost every year there was another gauge which was simultaneously recording the river-levels:—

Period.	Gauge.	Verified by
1825–1845	Roda	Barker, Holroyd, Bowring, Curzon, etc.
1845–1872	,,	Delta Barrage gauge.
1871–1902	Aswan	Roda, Barrage, and other gauges.
1891–1904	Wadi Halfa	Aswan and many other gauges.

These maxima may be graphically represented by plotting them as differences from the mean value of the series, as has been done in Fig. V.

Gauge-readings furnish only the level of the water surface from day to day, and not the volume of the water flowing past, which is really required. At Aswan a number of discharges were measured and a discharge-table computed, by which the volume flowing past that point at any given reading of the gauge could be determined.* At Khartum on the Blue Nile, and at Dueim on the White Nile, and on the Atbara discharges have been measured in 1902 and 1903, from which the volume of the floods of these years can be calculated with fair accuracy; these have been already discussed.

* 'Perennial Irrigation,' App. III. Table I. Cairo: 1894.

The volume discharged by the Nile in flood represents the surface run-off of the rainfall of the catchment basin, while that of the rest of the year is due to what has percolated into the ground and fed the springs; it is, therefore, the volume discharged by the river in flood which should be used in comparing the floods of different years, and the maximum gauge-readings of different years do not accurately represent this. As, however, it will be necessary to discuss as long a series of floods as possible to see if they show any trace of periodicity, whether a group of years of low flood is followed by a group of years of high flood with any regularity, it will be necessary before 1869 to employ the records of the Roda nilometer or those taken at the Delta Barrage.

When discharge observations are not available, the floods of various years can be represented in the following manner, which is more accurate than the maximum gauge-readings if daily readings are available: Five-day means * of the readings are taken for each year, and the average reading of each five-day period for all the years is taken; then the difference between a five-day mean for year and for the corresponding period of the series of years will show when the flood is above or below the average for each such five-day period. The sum of these differences furnishes a good means of comparing the different floods, though it is inferior to actual measurements of the discharge, since by using the sum of these differences it is assumed that the discharge increases in direct proportion to the rise of the gauge, whereas the discharge increases more rapidly, and a 0·10 metre rise at flood stage corresponds to a larger volume of water passing than a rise of the same amount at a lower stage of the river, while a gauge reading on a rising stage represents a larger discharge than the same reading on a falling stage.

As, however, it is necessary to employ the maximum readings as a basis of comparison between the floods of different years before 1869, it will be well to examine the relation between the floods of the years 1871 to 1902 as shown by—

(a) The volume of water discharged between July 1 and October 31.

(b) The sum of the differences between the five-day means and the average five-day mean between July 1 and October 31.

(c) The maximum gauge-readings.

If three curves are plotted representing the relative magnitudes of thirty-four Nile floods at Aswan according to the three methods above described, it is interesting to notice how closely they follow each other. Taking the curve of the "volumes discharged" as the most accurate, the curve of "differences from mean gauge" follows it closely, being sometimes slightly above it, at other times slightly below it. The agreement of the curve of "maximum gauge-readings" is less satisfactory, as would be expected; though it usually agrees fairly well, on

* That is, 1-5, 6-10, 11-15, 16-20, 21-25, 26 to the end of the month.

one or two occasions it differs markedly; for instance, in 1881, 1882, and in 1896. However, it may be claimed that, for the purpose of the present investigation, the curves of "differences from mean gauge" may fairly be used as a close approximation to the volume discharged for places such as Wadi Halfa and Khartum, 1869–1880, where daily readings for a series of years are available, while the curve of maximum gauge-readings will reproduce generally the shape of "volume discharged" curve, though occasionally diverging from it to some extent. It is the "maximum reading" curve alone which is available for Roda and the Delta Barrage * observations.

We therefore possess fairly reliable records of the maximum readings of the Nile floods for eighty years past. As far as 1846 these records can be controlled by the records of other gauges, and before that date the contemporary evidence of travellers and residents enables us to verify several of the more important years. These data should show some signs of an alternating series of high and low floods, that is of a periodicity in the floods, if such does exist. Brückner † has shown a periodicity in rainfall of thirty-five years from maximum to maximum, which he traces generally throughout the continental areas of the world, and which might be expected to appear here also.

In examining the Nile floods records for traces of periodicity, it must be remembered that it is the variation of the Abyssinian rainfall which is really being discussed, and the flood is used as being a convenient expression for the run-off, which is assumed to bear a fairly constant proportion each year to the rainfall. No data exists by which this assumption may be verified, but it is probably a reasonable one.

Flood Discharge, 1869–1902.—In Table XIII. is given the volume discharged in each year from 1869 to 1902 from July 1 to October 31, which has been computed from the discharge table given by Sir W. Willcocks.‡ The ratio between floods of different magnitude bears out what has been deduced from two years' discharges at Khartum (see pp. 264, 265), namely, that an abnormally low Nile is about two-thirds of the volume of a normal flood, while a maximum flood is nearly the double of an abnormally low flood. These proportions should naturally be reproduced in the Abyssinian rainfall of these years, but observations there are as yet too few to show this clearly.

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* Except for the years 1846–61, for which five-day means have been published by d'Arnaud.

† 'Klimaschwankungen.' Vienna: 1890.

‡ 'Perennial Irrigation,' App. III., Table 1. Cairo: 1894.

TABLE XIII.

VOLUME OF FLOOD AT ASWAN, JULY 1 TO OCTOBER 31, IN MILLIONS OF CUBIC METRES.

Year.	Ratio to mean flood.	Volume.	Variation from mean.	Mean of five years.	Variation from five-year mean.
1869	1·18	77,183·6	+11,965·4	—	—
1870	1·28	80,183·5	+14,995·8	—	—
1871	1·05	68,871·8	+ 3,183·6	70,551·7	+ 5,249·1
1872	1·11	72,065·4	+ 6,877·2	71,669·5	+ 6,366·9
1873	0·84	55,004·4	−10,188·8	69,992·2	+ 4,689·6
1874	1·26	82,622·6	+17,434·4	70,493·5	+ 5,190·9
1875	1·10	71,896·9	+ 6,708·7	65,197·3	− 105·3
1876	1·09	70,878·2	+ 5,690·0	70,312·8	+ 5,010·2
1877	0·70	45,584·2	−19,604·0	68,625·9	+ 3,323·3
1878	1·24	80,582·3	+15,394·1	67,089·7	+ 1,787·1
1879	1·14	74,187·8	+ 8,999·6	65,047·9	− 254·7
1880	0·98	64,215·9	− 972·3	66,857·8	+ 1,555·2
1881	0·93	60,669·2	− 4,519·0	64,302·7	− 999·9
1882	0·84	54,633·7	−10,554·5	60,350·5	− 4,952·1
1883	1·04	67,806·7	+ 2,618·5	60,439·0	− 4,863·6
1884	0·83	54,427·2	−10,761·0	60,171·9	− 5,130·7
1885	0·99	64,658·3	− 529·9	64,769·1	− 533·5
1886	0·91	59,333·5	− 5,854·7	60,568·0	− 4,734·6
1887	1·19	77,619·6	+12,431·4	62,659·8	− 2,642·8
1888	0·72	46,801·6	−18,386·6	64,363·7	− 938·9
1889	1·00	64,886·0	− 302·2	65,606·0	+ 303·4
1890	1·12	73,177·8	+ 7,989·6	65,738·0	+ 435·4
1891	1·01	65,544·8	+ 356·6	69,274·8	+ 3,972·2
1892	1·20	78,279·7	+13,091·5	72,190·1	+ 6,887·5
1893	0·99	64,485·9	− 702·3	72,556·6	+ 7,254·0
1894	1·22	79,462·5	+14,274·3	73,338·6	+ 8,036·0
1895	1·15	75,009·9	+ 9,821·7	69,259·8	+ 3,957·2
1896	1·06	69,455·2	+ 4,267·0	70,257·4	+ 4,954·8
1897	0·89	57,885·4	− 7,302·8	62,565·1	− 2,737·5
1898	1·07	69,473·8	+ 4,285·6	59,180·8	− 6,121·8
1899	0·63	41,001·1	−24,187·1	56,595·1	− 8,707·5
1900	0·89	58,088·4	− 7,099·8	53,306·5	−11,996·1
1901	0·87	56,526·8	− 8,661·4	51,049·9	−14,252·7
1902	0·63	41,442·6	−23,745·6	—	—
1903	0·89	58,190·4	− 6,997·8	—	—
	Mean ...	65,188·2	Mean ...	65,302·6	

It will be noticed that the mean volume discharged is 65,188 million cubic metres, which is not much greater than that obtained from the Khartum observations for 1903, a year somewhat below the normal, although the Aswan volume includes the discharge of the Atbara, and also that which the White Nile was contributing, a quantity which in July and October is not inconsiderable, though small in August and September (see Table VI.). These Aswan values would appear, therefore, to be rather below the truth. In the memoir where the discharge table is published, no details are given of the observations from which the table was computed. The greater discharge when the river is rising than when it is falling, for the same gauge-reading, is mentioned, but it is not stated how this was dealt with in preparing the table. However, though the totals may be rather low, their ratios to one another should not be appreciably altered, and for the present investigation it is these ratios which are required.

In 1904, the volume of the flood calculated in the same way was 49,020·8 millions of cubic metres, being 0·75 of a mean flood.

TABLE XIV.

MAXIMUM READINGS, ASWAN GAUGE.

A.D.	Metres.	Difference from mean.	Five-year mean.	Difference from mean.
1871	8·25	+0·14	—	—
1872	8·27	+0·16	—	—
1873	7·66	−0·45	8·30	+0·15
1874	8·97	+0·86	8·39	+0·24
1875	8·36	+0·25	8·01	−0·14
1876	8·68	+0·57	8·32	+0·17
1877	6·40	−1·71	8·25	+0·10
1878	9·21	+1·10	8·14	−0·01
1879	8·59	+0·48	8·03	−0·12
1880	7·82	−0·29	8·35	+0·20
1881	8·14	+0·03	8·15	0·00
1882	8·00	−0·11	7·97	−0·18
1883	8·18	+0·07	8·02	−0·13
1884	7·73	−0·38	8·00	−0·15
1885	8·05	−0·06	8·16	+0·01
1886	8·04	−0·07	7·94	−0·21
1887	8·81	+0·70	8·07	−0·08
1888	7·08	−1·08	8·20	+0·05
1889	8·36	+0·25	8·16	+0·01
1890	8·72	+0·61	8·18	+0·03
1891	7·84	−0·27	8·31	+0·16
1892	8·88	+0·77	8·36	+0·21
1893	7·75	−0·36	8·35	+0·20
1894	8·61	+0·50	8·51	+0·36
1895	8·68	+0·57	8·30	+0·15
1896	8·63	+0·52	8·47	+0·32
1897	7·80	−0·31	8·08	−0·07
1898	8·63	+0·52	7·93	−0·22
1899	6·67	−1·44	7·77	−0·38
1900	7·91	−0·20	7·55	−0·60
1901	7·91	−0·20	—	—
1902	7·82	−0·29	—	—

Tables XVI. and XVII. contain the maximum readings of the Roda gauge from 1736–1800, and from 1825 to 1872, together with the differences from the mean maximum and also the five-year means. Table XVIII. contains the same for the Barrage.

TABLE XV.

Maximum Readings of Roda Gauge.

A.D.	Pik.	Qirat.	Metres. +12·50.	Difference from mean.	Five-year mean. Metres. +12·50.	Five-year difference from mean.
1825	19	4	5·96	−1·21	—	—
1826	22	18	7·13	−0·04	—	—
1827	22	8	6·91	−0·26	6·90	−0·27
1828	21	14	6·62	−0·55	7·01	−0·16
1829	24	2	7·87	+0·70	6·98	−0·19
1830	21	8	6·54	−0·63	6·95	−0·22
1831	22	11	6·98	−0·19	6·80	−0·37
1832	21	23	6·73	−0·44	6·73	−0·44
1833	18	23	5·90	−1·27	6·64	−0·53
1834	23	10	7·50	+0·33	6·52	−0·65
1835	19	15	6·08	−1·09	6·36	−0·81
1836	20	17	6·37	−0·80	6·50	−0·67
1837	19	4	5·96	−1·21	6·39	−0·78
1838	21	12	6·59	−0·58	6·71	−0·46
1839	22	9	6·93	−0·24	7·00	−0·17
1840	23	18	7·68	+0·51	7·32	+0·15
1841	24	0	7·83	+0·66	7·38	+0·21
1842	23	14	7·59	+0·42	7·35	+0·18
1843	22	6	6·87	−0·30	7·09	−0·08
1844	22	3	6·80	−0·37	7·08	−0·09
1845	20	15	6·35	−0·62	7·03	−0·14
1846	23	23	7·80	+0·63	7·24	+0·07
1847	23	2	7·31	+0·14	7·47	+0·30
October 2, 1848	24	6	7·96	+0·79	7·54	+0·37
,, 7, 1849	24	5	7·93	+0·76	7·58	+0·41
September 19, 1850	21	20	6·69	−0·48	7·43	+0·26
October 3, 1851	24	9	8·02	+0·85	7·44	+0·27
August 31, 1852	21	8	6·54	−0·63	7·41	+0·24
October 1, 1853	24	9	8·02	+0·85	7·35	+0·18
September 29, 1854	23	23	7·80	+0·63	7·35	+0·18
1855	20	18	6·39	−0·78	7·38	+0·21
October 2, 1856	24	8	8·00	+0·83	7·10	−0·07
September 13, 1857	21	22	6·71	−0·46	6·85	−0·32
,, 6, 1858	21	14	6·62	−0·55	7·16	−0·01
October 27, 1859	21	7	6·53	−0·64	7·19	+0·02
,, 17, 1860	24	5	7·93	+0·76	7·30	+0·13
September 27, 1861	24	16	8·17	+1·00	7·65	+0·48
October 22, 1862	23	0	7·26	+0·09	7·58	+0·41
September 20, 1863	25	1	8·37	+1·20	7·44	+0·27
,, 20, 1864	19	21	6·15	−1·02	7·52	+0·35
October 18, 1865	22	23	7·24	+0·07	7·41	+0·24
September 27, 1866	25	11	8·59	+1·42	6·95	−0·22
,, 11, 1867	21	22	6·71	−0·46	7·45	+0·28
August 27, 1868	19	13	6·05	−1·12	7·65	+0·48
October 11, 1869	25	15	8·68	+1·51	7·45	+0·28
,, 14, 1870	24	17	8·20	+1·03	7·69	+0·52
September 27, 1871	23	16	7·63	+0·46	—	—
October 20, 1872	24	3	7·89	+0·72	—	—
	Mean	...	7·17	Mean ... 7·17		

Readings are taken from 'Statistique de l'Egypte,' 1883; see also Fritz, *Met. Zeit*, vol. 8, p. 363.

TABLE XVI.

Roda Gauge.

A.D.	Pik. Qirat.	Metres. +12·50.	Difference from mean.	Five-year mean. Metres. +12·50.	Difference from mean.
1737	20 18	6·39	−0·63	—	—
1738	24 12	8·09	+1·07	—	—
1739	23 12	7·54	+0·52	7·49	+0·47
1740	24 6	7·96	+0·94	7·72	+0·70
1741	23 8	7·46	+0·44	7·50	+0·48
1742	23 12	7·54	+0·52	7·44	+0·42
1743	22 12	7·00	−0·02	7·42	+0·40
1744	23 0	7·26	+0·24	7·43	+0·41
1745	24 0	7·83	+0·81	7·54	+0·52
1746	23 19	7·71	+0·69	7·51	+0·49
1747	24 3	7·89	+0·87	7·38	+0·36
1748	22 6	6·87	−0·15	7·29	+0·27
1749	21 12	6·59	−0·43	7·31	+0·29
1750	63 5	7·39	+0·37	7·24	+0·22
1751	24 0	7·83	+0·81	7·45	+0·43
1752	23 12	7·54	+0·52	7·43	+0·41
1753	24 8	7·89	+0·87	7·44	+0·42
1754	21 6	6·52	−0·50	7·44	+0·42
1755	23 6	7·41	+0·39	7·55	+0·53
1756	24 0	7·83	+0·81	7·59	+0·57
1757	24 12	8·09	+1·07	7·62	+0·60
1758	24 12	8·09	+1·07	7·56	+0·54
1759	21 19	6·68	−0·34	7·50	+0·48
1760	22 17	7·11	+0·09	7·16	+0·14
1761	23 12	7·54	+0·52	7·02	0·00
1762	20 17	6·37	−0·65	7·25	+0·23
1763	23 6	7·41	+0·39	7·31	+0·29
1764	24 0	7·83	+0·81	7·20	+0·18
1765	23 5	7·39	+0·37	7·19	+0·17
1766	22 12	7·00	−0·02	6·97	−0·05
1767	20 12	6·32	−0·70	7·05	+0·03
1768	23 5	7·39	+0·37	7·00	−0·02
1769	23 12	7·54	+0·52	7·03	+0·01
1770	21 12	6·59	−0·43	6·70	−0·32
1771	23 6	7·41	+0·39	6·89	−0·13
1772	19 16	6·09	−0·93	6·71	−0·31
1773	21 6	6·52	−0·50	6·89	−0·13
1774	22 6	6·87	−0·15	7·07	+0·05
1775	23 12	7·54	+0·52	6·89	−0·13
1776	21 6	6·52	−0·50	7·07	+0·05
1777	22 12	7·00	−0·02	7·26	+0·24
1778	23 6	7·41	+0·39	7·26	+0·24
1779	24 0	7·83	+0·81	7·33	+0·31
1780	23 12	7·54	+0·52	7·07	+0·05
1781	22 6	6·87	−0·15	6·72	−0·30
1782	18 6	5·70	−1·32	6·31	−0·71
1783	18 2	5·66	−1·36	6·04	−0·98
1784	18 12	5·77	−1·25	6·02	−1·00
1785	20 0	6·18	−0·84	6·30	−0·72
1786	22 2	6·78	−0·24	6·57	−0·45
1787	22 17	7·11	+0·09	6·77	−0·25
1788	22 12	7·00	−0·02	6·87	−0·15
1789	22 2	6·78	−0·24	6·80	−0·22
1790	21 18	6·66	−0·36	6·59	−0·43
1791	21 0	6·46	−0·56	6·43	−0·59
1792	19 14	6·07	−0·95	6·28	−0·74
1793	20 0	6·18	−0·84	6·23	−0·79
1794	19 12	6·04	−0·98	6·21	−0·81
1795	20 21	6·42	−0·60	6·26	−0·76
1796	20 12	6·32	−0·70	6·48	−0·54
1797	20 16	6·36	−0·66	6·56	−0·46
1798	22 23	7·24	+0·22	6·78	−0·29
1799	20 23	6·44	−0·58	—	—
1800	23 2	7·31	+0·29	—	—
	Mean ...	7·02		7·02	

TABLE XVII.

NILE GAUGE-READINGS AT BARRAGE (Fritz in *Met. Zeit.* vol. 15, 1880, p. 303).

A.D.	Metres.	Difference. from mean.	Five-year mean.	Difference from mean.
1846	7·24	+0·33	—	—
1847	6·48	−0·43	—	—
1848	7·53	+0·62	6·95	+0·02
1849	7·35	+0·44	6·97	+0·04
1850	6·13	−0·78	6·90	−0·03
1851	7·38	+0·47	6·92	−0·01
1852	6·01	−0·90	6·96	+0·03
1853	7·76	+0·85	6·92	−0·01
1854	7·50	+0·59	6·93	0·00
1855	5·94	−0·97	6·95	+0·02
1856	7·46	+0·55	6·61	−0·32
1857	6·09	−0·82	6·29	−0·64
1858	6·07	−0·84	6·59	−0·34
1859	5·90	−1·01	6·61	−0·32
1860	7·27	+0·36	6·72	−0·21
1861	7·73	+0·82	7·06	+0·13
1862	6·65	−0·26	7·04	+0·11
1863	7·73	+0·82	6·89	−0·04
1864	5·80	−1·11	6·89	−0·04
1865	6·52	−0·39	6·84	−0·09
1866	7·76	+0·85	6·46	−0·47
1867	6·38	−0·53	6·87	−0·06
1868	5·83	−1·08	7·06	+0·13
1869	7·85	+0·94	7·01	+0·08
1870	7·50	+0·59	7·19	+0·26
1871	7·48	+0·57	7·30	+0·36
1872	7·32	+0·41	7·35	+0·42
1873	6·45	−0·46	7·28	+0·35
1874	7·98	+1·07	7·28	+0·35
1875	7·15	+0·24	6·85	+0·08
1876	7·50	+0·59	7·20	+0·27
1877	5·18	−1·73	—	—
1878	8·20	+1·29	—	—
Mean ...	6·91		6·93	

In seeking for evidence of periodicity in a long series of observations, it is often helpful to eliminate as far as possible small accidental variations which may otherwise hide the periodical variations. This is conveniently done by taking successively the means of groups of five years, and then comparing these mean values. For studying the effect of varying meteorological conditions the yearly values are necessary, and in the tables both the yearly values and the five-year means are given; the former being more useful in studying the effect of the meteorological conditions and the possibility of prediction, while the latter concerns the question of periodicity.

On Fig. V. the Nile floods for the 78 years 1825–1902 are shown, as well as an earlier series of 64 years from 1737 to 1800 on Fig. VI.; up to 1872 the variation of the maximum reading of the Roda gauge from the mean * is plotted on the scale of 1 : 20, but from 1869 to 1902†

* Column 4 of Table XV.

† Column 4 of Table XIII.

the variation of the volume discharged in each year's flood from the mean value for the 32 years 1871–1902 is plotted on the scale of 1 centimetre to 200 millions of cubic metres. Over this record of the yearly flood is plotted the curve of the five-year means,* the mean value for each five-year group being plotted under the middle year of the group.†

In the first place, the more reliable series 1825–1902 will be examined, for any sign of a regular alternation of groups of high and low floods will have a greater value here than in the older series, being obtained from more reliable data. The five-year mean curve shows a certain alteration; low periods occur as follows:—

	Duration.	Intervening period.
1829–1848	19 years	8 years.
1856–1860	4 "	21 "
1881–1888	7 "	9 "
1897–1902	5 "	

But these intervening high-flood periods are broken by groups of years which reduce the curve to the normal line, as in 1843–46, 1855–56, and 1867. To take the Aswan observations 1869–1903 alone, an apparent periodicity of about seventeen years from maximum to maximum occurs, but in the preceding years no trace of such period is to be found.

Fritz,‡ when discussing the Roda series 1825–1872 and the Delta Barrage series from 1846–1878, believed that a relation could be made out between the high and low Nile floods and the maxima and minima of the sunspot curve, and Waite § has recently maintained the same. On Figs. V. and VI. the sunspot curve has been plotted from the numbers given by Wolfer,‖ but it does not appear to bear any definite relation to either the five-year curve or the yearly flood curve; the maximum of 1837 coincided with a group of particularly low floods, that of 1846 with a high-flood period. In 1860 the sunspot maximum occurred just before the high floods of 1860 and 1861, and after the low years of 1857–59; the low sunspot maximum of 1883 occurred at the time of a group of low floods, and the improved Nile supply came in 1887, 1889, and 1890, when the sunspots were at minimum. Whatever connection may finally be worked out between sunspots and meteorological phenomena, it seems clear that the Abyssinian rainfall is due to the combined effect of causes which usually prevent any coincidence between high and low floods and the maxima and minima of the sunspots which may exist, from being recognized, and to predict improved

* Tables XIII. and XIV.

† The mean of 1871–1875 is plotted under 1873, and that for 1872–1876 under 1874, and so on.

‡ *Met. Zeit.*, **13**, p. 363; and **15**, p. 303.

§ *Scot. Geog. Mag.*, 1904, p. 487.

‖ Waite, *loc. cit.*

floods on the basis of an approaching sunspot maximum * seems to go further than the evidence warrants.

In 1900, Sir N. Lockyer and Dr. W. Lockyer † discussed periodical pulses of rainfall, which they distinguished as + and − pulses connected with + and − heat pulses of the solar weather cycle.

As a result of an examination of the spectra of sunspots and of the rainfall of India and Mauritius, they concluded that India has two pulses of rainfall, the one near the maximum and the other near the minimum of the sunspot period, and that the dates of the beginning of these two pulses are related to sudden changes in widened lines of the spectra. The famines of India for the last half-century were found to occur in the intervals between these pulses, and the lowest Nile floods between 1849 and 1878 are said to have occurred between the same intervals. These pulses are given as follows:—

− Pulse.	Mean condition.	+ Pulse.
	1869	
		1870-5
	1876	
1877-80		
	1881	
		1882-6
	1886-7	
1888-91		
	1891-2	
		1892

According to this view, then, low Nile floods should predominate about 1869, 1876, 1881, 1887, and 1892, while high floods should follow the years of the + and − pulses. They deal briefly with some of the Nile floods in this paper, pointing out that "the highest Niles follow the years of the + and − pulses."

1871	flood,	1 year after the + pulse of 1870.
1876	„	2 „ subsidiary pulse of 1874.
1879	„	2 „ „ „ 1877.
1883-4	„	1 and 2 years after the + pulse of 1882.
1893-4	„	1 „ 2 „ „ + „ 1892.

It does not seem, though, that such a direct and simple relation can be made out for the Abyssinian rainfall; the 1871 flood was less than those of 1869, 1870, or 1872, while 1874, and not 1876, was the big flood to compare with the pulse of 1874, and 1878 was a year of heavier rainfall than 1879, and particularly a very late rainfall, extending far into the autumn; 1883 and 1884 were moderate and rather low years respectively. These discrepancies are mentioned to show that the dates of the + and − pulses by themselves do not consistently precede

* *Met. Zeit.*, 1902, p. 193.

† *Proc. Royal Society*, vol. 67, p. 409.

specially high floods, and therefore this periodicity of five or six years is not traceable in the yearly or five-year Nile curves.

The low Nile floods quoted are those of 1858–9, 1868, 1873, 1877, but it should be noticed (see Fig. V.) that the floods of 1858–9 were not especially low; 1857 was almost as low as 1858, and 1855 was lower than either; 1868 was a very low year, but 1864 was almost as low; 1873 was a low flood, and 1877 a very low flood. Turning to the other "mean condition" years which should coincide with low floods, 1881 was a normal flood, 1887 was a good flood, though 1888 was a bad one, and 1892 was particularly good, 1888 and 1899 being the nearest bad years to this date.

It would seem, therefore, that Egypt and Abyssinia form an area in which the meteorological conditions are not regularly consonant with those of India discussed by Sir N. Lockyer; at times agreeing and at other times varying widely, the solar weather is as yet an uncertain guide in the study of Nile floods.

A longer period of about thirty-five years from maximum to maximum has been found by Brückner * to exist generally over the globe, with certain few exceptions, for rainfall and also for temperature and atmospheric pressure. The approximate dates of the maxima and minima of periods of rainfall are shown on Fig. V. by the words "Wet" and "Dry," † but they will be seen to stand in no fixed relation to the five-year mean curves of the Nile floods. If, however, we take the different rises and falls of the flood curve, we see that in departing from Brückner's regular curve it approaches to some extent the curve which he gives for the areas which he has classed as "temporary exceptions (*temporäre Ausnahme*)" ‡ (see Fig. IV.); these areas show a low period in the lustrum 1855–60, a well-defined high one in 1861–65, and again a brief though sharply marked low period in 1865–70, as well as a steady fall from 1875 to 1887. The areas described as "temporary exceptions" are naturally not very numerous compared with those following the regular alternation, and do not among themselves show a very close agreement, but the occurrence of an 1860–65 maximum of the Nile floods during a dry period, and steady increase in the lustra 1875–80 and 1880–85 in a normally wet period, show that the normal Brückner cycle cannot apply to the Abyssinian rainfall, and it is probable that any anticipations of improvement or diminution of coming floods based upon their position in this normal cycle will not be realized. In Fig. IV. are shown the curves for the regular and temporary exceptional areas of Brückner as well as the curve for the Nile floods; in each case the curve is plotted from the mean value of

* 'Klimaschwankungen.' Vienna: 1890.

† Cf. *Ibid.*, p. 192; and *Pet. Mitt.*, 1902, pp. 173–176.

‡ 'Klimaschwankungen,' p. 171.

each lustrum. It can be seen that the Nile flood varied according to the normal type from 1830 until 1860, but after that departed markedly from it, especially about 1875 to 1885.

Turning now to the yearly curve for the seventy-eight years from 1821 to 1902 in Fig. V., the most marked feature is the way in which the flood varies, passing from a value above the normal to one below it in almost successive years. It is this irregularity, this rapid oscillation of the curve, which makes of small practical value any argument based on a periodicity shown by the five-year curve; for in the most regular group of low floods, a high flood may intrude itself, as 1829 and 1834, also 1887; while 1873 and 1877 were very low floods among a group of floods all much above the average. If this series of floods be examined, we shall see that from 1825 to 1903 the succession is as follows:—

In seventeen cases a flood *above* the average is followed by one *below* the average.

In eighteen cases a flood *above* the average is followed by one *above* the average.

In twenty-one cases a flood *below* the average is followed by one *below* the average.

In sixteen cases a flood *below* the average is followed by one *above* the average.

Even in periods when high or low Niles greatly predominate, such as 1825–1839 or 1860–1880, floods of the opposite character frequently occur, *e.g.* the high flood of 1829 in the first period of low floods, and the low floods of 1864, 1869, and 1877 in the high-flood period of 1860–1880.

In these seventy-eight years—

2	successive	years	above	the average occur	three times.
3	"	"	"	"	"
4	"	"	"	"	"
2	"	"	below	"	once.
3	"	"	"	"	three times.
4	"	"	"	"	twice.
5	"	"	"	"	"

of which the last two groups belong to the low-flood periods of 1825–1839 and 1899–1903.

Since the Nile flood is the direct result of the June—September rainfall on the Abyssinian tableland, the rains and the meteorological conditions which determine them must be subject to a similar oscillation to that which is so markedly shown in the flood diagrams. Essentially the succession of Nile floods for the last eighty years is an oscillation between floods above the average and floods below the average, and the same thing is seen in the series from 1737 to 1800 (Fig. VI.), though the range of the oscillation is not so large if the observations can be relied on.

The long series of years following 1738 in which the Nile flood was almost invariably good is corroborated by Bruce, who writes, "The Nile for these thirty years has but once so failed as to occasion dearth, but never in that period so as to produce famine in Egypt." * This refers apparently to the thirty years previous to 1773,† the low Nile being perhaps that of 1772. He further speaks of three of these floods having been exceptionally abundant, which would apply to those of 1757, 1758, and perhaps 1753. The exceptionally low floods of 1783 and 1784 are mentioned by Volney,‡ who speaks of them as causing a serious famine.

For comparison with this earlier series of years, rainfall data do not exist as for the nineteenth century; still, it can be said with certainty that the curve is not one which shows any more similarity to the alternating dry and wet groups of years having a period of about thirty-five years, than has been found in the later series.

We may conclude, then, with reference to the variation of the Nile flood from year to year, that no trace appears of any such definite periodicity as might be of assistance in estimating the probable duration of any succession of high or low Nile floods.

In the sixty-four years (1736–1800) of the eighteenth century, the oscillation between excessive and deficient floods is on the whole much the same as for the nineteenth century.

In thirteen cases a flood *above* the average is followed by one *below* the average.

In twenty cases a flood *above* the average is followed by one *above* the average.

In eighteen cases a flood *below* the average is followed by one *below* the average.

In twelve cases a flood *below* the average is followed by one *above* the average.

2	successive floods	above	the average	occur	twice.
3	,,	,,	,,	,,	,,
4	,,	,,	,,	,,	three times.
5	,,	,,	,,	,,	once.
2	,,	below	,,	,,	three times.
3	,,	,,	,,	,,	once.
6	,,	,,	,,	,,	,,
10	,,	,,	,,	,,	,,

The long period from 1781 to 1799, when apparently all floods except two were below the average, prevents any average length of the oscillation between floods in excess or defect being estimated satisfactorily.

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* 'Travels to discover the Source of the Nile,' 2nd edit., vol. 5, p. 375. London: 1805.

† *Ibid.*, p. 412, note.

‡ 'Voyage en Egypte et en Syrie,' 5th edit., vol. 1, p. 157. Paris: 1822.

Essentially, then, the Abyssinian rainfall, which we have represented by the Nile flood, fluctuates at short intervals, and does not increase more or less regularly for a period of years, and then decrease in a similar way. These fluctuations are short, and if the number of years between the different crests of the curve is taken (whether such crests rise above the average or not), the length of time between such crests is—

2	years in	twelve	cases in the	nineteenth	century.
3	,,	six	,,	,,	,,
4	,,	three	,,	,,	,,
5	,,	four	,,	,,	,,
2	,,	five	,,	eighteenth	,,
3	,,	two	,,	,,	,,
4	,,	four	,,	,,	,,
5	,,	two	,,	,,	,,
8	,,	one	case in the	,,	,,
11	,,	,,	,,	,,	,,

We have, therefore, to deal with a comparatively short-period variation in the meteorological conditions, but this subject requires further investigation.

It is often said that the Indian monsoon rainfall and the Nile floods agree in showing excess or deficiency, but this is in reality far from being the case, and discordance is fairly frequent.

Sir W. Willcocks, in a paper at the Meteorological Congress at Chicago, 1892, stated that famine years in India were years of low supply in Egypt; and Sir J. Eliot, in his forecast of the probable character of the south-west monsoon of 1900, supports this.* His latest views on the Indian monsoon are fully set forth in his address to Section A (Sub-section, Cosmical Physics) of the British Association, 1904.† He considers that local or general drought in India may be due, among other things, to a larger diversion than usual of the monsoon currents to Burma or Abyssinia, and later he states that the Nile floods of the period 1895–1902 followed closely the variations of the rainfall in Western India, showing that the Abyssinian rainfall was more or less generally in defect, and most largely in 1899 and 1901.‡

Since the tropical rains are all caused primarily by the transfer northward of the equatorial rain-belt, followed by the northward extension of the south-east trade winds, it follows that probably a weakness of the winds in one area may also be felt in neighbouring areas in similar latitude. But there are other causes at work which affect the Nile

* *Nature*, August 23, 1900, p. 392.

† *Ibid.*, August 25, 1904, p. 399.

‡ This should be 1902; the 1901 flood, though below the mean, was much better than that of 1902.

flood and may cause it to depart from its usual agreement with the south-west monsoon of India. In the following table are given the

TABLE XVIII.

Year.	Ratio of Nile flood to mean flood.	Variation from normal of Indian rainfall. Year.*	June–Sept.§	June–Dec.	Bombay rainfall—April–Sept.‡	S.W. monsoon rains.
		in.	in.	in.	in.	
1875	1·11	+ 2·38	—	—	+13·08	More abundant than usual, except in Bengal.
1876	1·10	− 4·49	−3·4	—	−21·00	Very deficient, especially in Bombay.
1877	0·71	− 4·28	−9·3	—	+ 1·40	Very deficient, except Burma.
1878	1·25	+ 6·34	+2·9	—	+41·71	Abundant, except Burma, N.W. Provinces, and Bihar.
1879	1·15	+ 1·69	+2·7	—	− 9·64	More or less above average.
1880	0·99	+ 1·56	−2·6	—	− 3·10	Excess over N.E. India and Burma; defect over N.W. and Western India.
1881	0·64	+ 0·10	+2·4	—	+ 1·99	Excess, except in Madras, Mysore, and Assam.
1882	0·65	+ 2·64	+2·1	—	− 1·92	Deficient in N.E. India excess over rest of India.
1883	1·05	+ 0·12	−1·7	—	+19·05	Deficient, except Bombay and Central Provinces.
1884	0·84	+ 1·73	+2·5	—	+ 3·26	More or less in excess, except parts of Bengal and Assam.
1885	1·00	+ 1·05	+0·8	—	− 3·10	Deficient Bombay, Berar, Punjaub; excess elsewhere.
1886	0·92	+ 3·02	+1·4	—	+28·72	Moderate excess, except Central India and Central Provinces.
1887	1·21	+ 2·42	+0·1	—	+23·76	Practically normal.
1888	0·72	+ 1·54	+0·6	—	−15·16	Normal or slight defect in India generally.
1889	1·00	+ 2·41	+3·3	—	− 3·26	Moderate to considerable excess, but defect in Sind and Punjaub.
1890	1·13	+ 0·68	+1·3	—	− 5·97	In excess generally; in defect in Burma.
1891	1·02	+ 3·54	−4·9 †	− 4·25 *	+ 5·94	More or less in defect, except N W and Central Provinces.
1892	1·21	+ 5·09	+1·6 †	+ 5·69	+24·10	Slight to moderate excess over India.
1893	1·00	+ 9·07	+1·0 †	+ 4·72	− 4·13	Slight to moderate excess
1894	1·23	+ 6·47	+4·4 †	+ 6·75	− 4·46	General excess, except east coast.
1895	1·16	+ 2·19	—	− 1·95	− 8·49	
1896	1·03	+ 4·83	—	− 3·59	+16·63	
1897	0·90	+ 0·15	—	− 0·02	+10·51	
1898	1·07	+ 0·43	—	+ 0·93	+ 2·91	
1899	0·63	+11·14	—	−11·34	−36·68	
1900	0·90	+ 0·57	—	− 0·26	− 1·87	
1901	0·88	+ 4·13	—	− 5·12	—	
1902	0·64	+ 2·05	—	− 1·64	—	

* Eliot, 1875–1896, *Nature*, June 3, 1897, p. 110; 1897–1902, *Ibid.*, August 25, 1904, p. 403.
† Period June to October. ‡ *Ind. Met. Mem.*, vol. **14**. § *Ibid.*, vol. **6**, pt. ii, p. 110.

variations of the Indian rainfall from the mean, and also of the south-west monsoon for twenty-eight years, as well as short notes on the character of the monsoon rains for different years.||

|| *Indian Meteorological Memoirs*, vol. **6**, part ii. pp. 109–110.

From this it is evident that the agreement is not invariable; in years of excessive precipitation, or of famine, the favourable or the unfavourable conditions will be at their strongest, and therefore will be most likely to extend widely. The test cases should be drawn from the years of more normal conditions. In these twenty-eight years, 1876, 1883, 1891, 1895, 1896 were above the mean in Egypt and below it in India, while 1881, 1882, 1884, 1886 were below the mean in Egypt and above it in India; thus nine years out of twenty-eight are not in agreement. Some do not differ widely from the mean, but they are not concordant, and show that the south-west monsoon is not by itself a safe guide to the character of the Abyssinian rains.

This investigation has now been carried further, and it has been found that a close relation exists between + and − anomalies of atmospheric pressure over Egypt and the neighbouring areas, and the defect or excess in the volume of the Nile flood. That such meteorological phenomena show a comparatively short period of oscillation has been pointed out by Sir J. Eliot, Sir N. Lockyer, Dr. W. J. Lockyer, Prof. Bigelow, and others. In the case of the Nile floods, local meteorological conditions affect this oscillation and increase the irregularity. Generally, then, it may be said that, so far as our knowledge goes at present, the Nile flood depends on, primarily, the strength of the monsoon air-currents from the Indian ocean, but modified by the pressure conditions which exist over North-East Africa, as I have shown in a recent paper.*

The following discussion took place:—

Sir Colin Scott Moncrieff: I do not know that I have much to say. I listened to Captain Lyons's paper and also read it with a great deal of interest. The way he is proceeding to show what does not cause the Nile flood is very satisfactory. By degrees we shall perhaps get at what does cause it. For a number of years I took the greatest interest in this matter, and these curves we have before us call back to my mind the way I made them out day by day, and kept the register of the Nile gauge for nine years. We got our readings every day from Khartum, from Berber, and from Wadi Halfa, until one fine morning the rain-gauge did not come in from Khartum, and it did not come in for about fifteen years, for the Mahdi was ruling the Sudan. After we first had our information cut off from Khartum, I tried to find if there was any connection with the rainfall at Zanzibar; but I could make nothing out of it. I was not encouraged at that time to believe there was much connection with the rains in India. We must just go on working, and by degrees I hope we shall get to the right thing. I am sure we are very much obliged to Captain Lyons, who has done more on this subject than all his predecessors put together.

Sir John Eliot: I might perhaps make one or two remarks. I am not quite certain whether there is some connection between the rainfall in India and [illegible] Abyssinia and the Nile regions, but I think it is only sufficient to mention [illegible] year 1899. The deficiency in India in 1899 was phenomenal. I have just [illegible]

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* "On the Relation between Variation of Atmospheric Pressure in North-[illegible] Africa and the Nile Flood," *Proc. Roy. Soc.*, 1905.

from Captain Lyons that the Nile flood as indicated or measured by the gauge at Assuan was the lowest on record. The rainfall was deficient in the same year in the Mauritius, South Africa, and also in parts of Australia. I think that is quite sufficient to show there seems to be some very large connection between the rainfall in the whole of the Indo-oceanic area. I cannot give you data at present, and I can only give you that one case. In respect to the comparison with the rainfall in India, I would like to make one suggestion, as I have had something to do with drawing up the figures. There are two elements—first, as to whether you take your readings at a sufficient number of stations; and, secondly, whether you have rainfall data for a sufficient number of years to give you an approximate average for that area. I am not quite certain whether we have got to that stage in India as yet. When it comes to small variations for the whole of India, plus or minus, if you were to arrange the stations differently, it is very possible you would get different variations. For comparisons between rainfall variations in two areas, I should go more upon the correspondence of large variations than I should upon the correspondency of two curves. The only other point I wish to mention is the conclusion at which Captain Lyons arrives. He says, "Generally, then, it may be said that, so far as our knowledge goes at present, the Nile flood depends on, primarily, the strength of the monsoon air-currents from the Indian ocean, but modified by the pressure conditions which exist over North-East Africa." That is exactly what I have found for many years past in India, and of those two effects, the largest is produced by the Indian ocean. I think the paper is a most valuable one, and I only wish I had had the information contained in it five years ago.

Dr. W. M. Shaw: In relation to what Sir Colin Scott Moncrieff has said, we may find encouragement in the paper for meteorological work, from the conclusion that the flood conditions of Lower Egypt depend upon the rainfall in Abyssinia. The relation of conditions in Lower Egypt and in Abyssinia is easy to accept, because there is a river to connect them. There are connections in other parts of the world which really exist and deserve to be traced out, although one cannot point to a river on the map as the connection between them. For that reason we have reason to be grateful to Captain Lyons for the energetic way in which he is looking after his neighbours' observations. Observations are often taken with the understanding and the hope that they may be useful to other people, if not to ourselves. When that hope gets faint, there is a tendency for the observer to be discouraged. If Captain Lyons has done nothing else, he has shown that observations in widely different parts of the world may be of real importance to neighbours in the first place, and to the whole community in the second place. The determination of the relation or want of relation between plotted curves of variations of various elements from year to year is a subject that grows in importance as successive people take it up. It requires, I presume, an accomplished mathematician to deal with the curves and their periods, but our information is slowly accumulating, and I have no doubt that if we could get together a body of persons devoted to studying the relations of the meteorological phenomena of one country to those of others in the way that Sir John Eliot has suggested, and the India Office is, I believe, prepared to support, we should feel our gratitude to Captain Lyons strengthened by the fact that the observations he has organized, examined, and put together will contribute towards placing the relations between the meteorological conditions of different countries beyond cavil or doubt.

Colonel Hon. M. G. Talbot: I should like, as a late Sudan official, to testify to the thoroughness of Captain Lyons' work there. You have noticed, naturally, that all the data obtained in this paper has been obtained through the Egyptian and not the Sudan Government, and the same applies to the meteorological data that Captain Lyons has collected and embodied in his other papers on the meteorological conditions of the Nile basin. The Sudan Government was sympathetic, but it had neither the money to provide the necessary instruments and observers, nor had it any one nearly so well qualified to undertake the superintendence as Captain Lyons. Captain Lyons and I have often corresponded regarding the observations, sending out instruments, and that sort of thing, and knowing well the great difficulties he has had to contend with, not only in the way of providing the necessary instruments, but in getting reliable observers in the Sudan, I can testify how entirely the collection of the meteorological data in the Sudan, so important for the study of the Nile flood, is due to his initiative and unceasing push and energy.

Dr. H. R. Mill: This paper is one which I think is of very special interest to this Society, because it brings to the solution of a geographical problem the facts that are ascertained by the study of another science—meteorology. In hearing this discussion of the Nile flood, the first idea, I think, that must come into the mind of any geographer is that the supposed importance of the Victoria Nyanza has been greatly diminished. I remember very well when we were endeavouring to start meteorological observations in tropical Africa, the work that Mr. Ravenstein took up with such energy and success there gave great hopes that the observations of rainfall round the great lakes were going to open a way to the solution of the problem of the changes in the floods of the Nile; this is now shown to be a mistake. The centre of the problem has been shifted back to the rainfall on the Abyssinian heights; and that this rainfall has the whole responsibility of producing the floods has been clearly brought out by Captain Lyons's paper. There is one fact on which he touched, but did not fully treat, that, I think, shows his estimate of the dependence of the floods on the Abyssinian rains to be almost numerically correct. When the variations in the height of the flood were expressed as a ratio to the mean flood, I noticed that these variations almost exactly correspond with the well-known variations of rainfall as they have been determined, not in this country only, but all over the world; that is to say, that the minimum year's rainfall is something approaching two-thirds of the average, and the maximum is something approaching one and a half times the average—rather more than twice the minimum. But a still more clearly established relationship with regard to rainfall averages is the average of the three dryest consecutive years that are likely to be experienced. The three dryest consecutive years in any period of thirty-five years and more have been found—and this relation holds in all parts of the world—to be about 80 per cent. of the true average fall. Now, I have looked at those figures of the Nile ratio here, and I find that the three dryest years, 1899, 1900, 1901, come out almost exactly with a ratio of 80 per cent. to the average, and that certainly would, on the face of it, suggest that the Nile flood is a direct measure of the rain of the district that produces it. I am not quite sure how far there may be variations in the evaporation; but I suppose that the climate of Abyssinia and the Sudan is so nearly invariable that there is not a very large difference between one year and another. It will be extremely interesting, and, I should say, absolutely necessary, to get observations set on foot in Abyssinia, so that we may have actual figures, and not merely indications, to go upon. And I think, from the energy with which Captain Lyons is pursuing his investigations in that direction, this result will be obtained before long. It would be a great thing if this Society and other learned societies could do something to help that forward. But a remark that fell from Sir John Eliot, I think, is more important than the establishment of isolated stations; that is, the comparative study of the results when obtained. Sir John Eliot laid stress, wisely, on the extreme danger of deducing rainfall averages over large areas of country from an inadequate number of stations. His remark points to the necessity of using, not the station, but the area as the unit, and of studying the rainfall question from a geographical quite as much as from a meteorological point of view. I am now endeavouring to do this with regard to British rainfall. The number of stations, I am happy to say, is now about 4000, but even with all these the difficulty of ascertaining the relative wetness of different years in a long period is great, and it seems quite hopeless to attempt to do so by comparing any one individual station with another. The only way I see for getting the basis for a strictly scientific comparison of the variations of rainfall from year to year for the country as a whole, or any large region, is to work out the rainfall each year on different areas, and then by some method, either by arithmetical treatment or otherwise, get the averages for a long time.

Dr. Herbertson: I had no intention of speaking this afternoon, but I am very glad of the opportunity of thanking Captain Lyons for this most valuable contribution to a problem which has interested mankind for many centuries. It occurred to me during the reading of the paper and the subsequent speakers' remarks that it is very necessary that there should be some organization for discussing the meteorological observations in distant parts of the world. One would like to see a sort of International Meteorological Bureau, which would deal with meteorological observations from a selected number of stations for the whole world, and regularly discuss the world distribution of meteorological elements, their normal sequences and variations. In the case of the rainfall of Abyssinia, we obviously have to deal with pressure conditions where there is a baric ridge with sinking gradients to south and north. We want to know the normal conditions of pressure in this ridge and its slopes, the height of the barometer along the maximum area, and the relations to surrounding baric maxima and minima, and the depressions in the minima. That cannot be ascertained by one observer, nor dealt with satisfactorily by one of the ordinary weather bureaus. It requires a special bureau to discuss so large a question. Another matter which occurred to me was, how far the water of these Abyssinian rivers could be used for irrigation in the lower part of their courses before they reached the Nile, and how far that would affect the supply of water to the irrigation canals of Egypt. A last point is, may we not still see a great use in the equatorial rainfall and the Victoria Nyanza, and other lake basins, in keeping the level of the Nile constant during the winter months in Egypt, and so helping the perennial irrigation in the lower courses of the river?

Sir Thomas Holdich: I am not an Egyptian official, neither do I belong to the Sudan, but as an outsider perhaps I may be allowed to give one little bit of evidence. In the year 1868 I was doing the best I could to survey the upper sources of the Atbara at the beginning of the monsoon season. You may remember, perhaps, that one of the main difficulties of effecting a dignified retirement from Abyssinia at the close of the expedition was the coming of the rains, which washed down with such force that in some of the narrower gorges the level of the water was raised 18 feet. You will admit, I think, that I was not at a bad point for observation, for there to the east we had the Red sea, with Annesley bay below us, and on the west the Nile basin leading to the Mediterranean. I am positively certain that on that occasion, at any rate, the commencement of the monsoon influenced both areas. The same wind, the same general lowering temperature, the same variations of weather which prevailed in the Red Sea at that time (and which were exceedingly inconvenient to the expedition), prevailed also on the Abyssinian plateau, and sent down floods to the Nile. From that day to this I have always believed the south-west monsoon to be the origin of rainfall simultaneously in the Nile basin and in India, however unequally that rainfall may happen to be distributed.

Mr. CHISHOLM: The only observation I have to make on this very interesting paper is one suggested by something that has just been mentioned by Sir Thomas Holdich. It seems to me that one of the most important points brought before this meeting by the paper of Captain Lyons, viz. the fact that the floods of the Nile are mainly due to the drainage of the Abyssinian mountains, and not so much to the White Nile, is one that need not have excited, in the circumstances, any very great amount of surprise. Sir Thomas Holdich has just told us of the remarkably sudden rise of the rivers in Abyssinia, of which he had been a witness, and that induces me to ask him whether he can say anything with regard to the geological structure of Abyssinia; that is to say, whether Abyssinia is to a very large extent composed of a very hard rock—a hard impermeable rock that would not allow rain to sink in.

Sir THOMAS HOLDICH: Yes, it is so.

Mr. CHISHOLM: That being so, this structure, combined with the differences in altitude in Abyssinia, will have the effect that what rain falls there will find its way with remarkable speed into the mountain river, and ultimately cause a rapid change in the amount of flood in the Blue Nile at the junction of the White Nile. We know that in the Sudan the conditions are entirely different. We have there a vast alluvial country into which the rainfall will in a large measure gradually percolate into the streams, and in a large measure be brought to the surface again by capillarity and re-evaporated. Through such differences in physical conditions we have enormous differences in the behaviour of the rivers in different parts of the world. I believe, for example, it is the case that the maximum discharge of the Mahánadi may reach on certain occasions as high as that of the Ganges; but in the case of the Mahánadi the maximum may last for twelve hours, while in that of the Ganges it will go on for about three weeks, this difference arising from the fact that the Ganges flows through vast alluvial flats, whereas the Mahánadi flows through an area of hard crystalline rocks with steep slopes.

Mr. J. A. BAINES: Sir John Eliot has pointed out one instance of remarkable coincidence between the rainfall of Western India and the height of the flood on the Blue Nile, and there appears, also, to be a less marked but still perceptible instance of the same character in 1877. Both these, however, are in the direction of abnormal deficiency of rainfall, and to establish the fact that the influence of violent oscillations from the mean is common to both regions, it is necessary to ascertain that abnormal excess also is simultaneous. Perhaps Sir John Eliot, whose knowledge of the Indian monsoon is unrivalled, may be able to quote a year or two in which the fall, not merely on the west coast of India, but about 100 miles inland, was markedly above the average, so that we can see on the diagram whether a corresponding excess was recorded in the Abyssinian highlands. Another point which seems worth explanation is the very remarkable difference between the curve of quinquennial average variation on the Nile before and after the early seventies. The earlier curves appear to vary from year to year, whilst, of late, several years in succession seem to be subject to the same influence, and the curve is thus much more extended.

Captain LYONS: I am very glad Sir John Eliot agrees with me in my conclusion at the end as to the possible local effect on the variations of pressure. I may be over-sanguine, but my own feeling is, if we study the meteorology, not only of the Sudan, but of the other areas to the south, we may be able to form an estimate whether the rainfall in Abyssinia is likely to increase or decrease for a month ahead. This year a beginning was made, and rainfall was telegraphed monthly from Uganda and British East Africa; in the latter area it was good, in the former poor, while on the Bahr-el-Jebel, particularly in April and May, it absolutely failed. The result was that the Sobat and the Blue Nile were nearly three weeks late in their first rise, as was to be expected. Dr. Mill spoke of the Victoria Nyanza as having been practically eliminated from the question, and asked about the effect of the Victoria Nyanza at the low stage of the Nile. Captain Owen, whose map was published in the *Journal* a short time ago, and also others, have told me there appears no doubt that the water-level in the Mruli-Foweira reach of the Nile is practically constant throughout the year, dry or rainy season, and the river is bank full there, so that the volume discharged is practically constant. Variations of discharge at the Ripon falls are regulated in the low marshy depression of Lakes Choga and Rawania. The discharge measured by Sir W. Garstin in March, 1903, below the Murchison falls, certainly was practically the same as that at Foweira at that season; that is to say, 550 to 560 cubic metres a second, constantly, throughout the year, represents the amount supplied by the Victoria Nyanza and its basin. The low stage of the Nile to which Dr. Herbertson referred raises another point. Throughout the year, at the mouth of the Bahr-el-Jebel, there is a constant discharge of nearly 300 cubic metres a second, because the marshes take up both the flood and the local rains of the summer. Therefore, adding the Bahr-el-Ghazal and Bahr-el-Zaraf, the constant discharge that goes down to the White Nile is about 400 cubic metres a second. The variable factors are the Sobat and the Blue Nile; if the rains are very heavy, and a certain amount is taken up in the soil, the springs are well filled, the rivers run down more slowly, and more water comes down the Sobat and the Nile in the winter. On the other hand, with moderate summer rains, which are continued, and even may become unusually heavy in September and October, although the flood may be a poor one, there may still be a good low-stage supply, because the Sobat and the Blue Nile are fed more than usual by the October rains. This happened in 1904, because the 1903 rains were continued well into September and October; exactly the opposite happened this year, when the 1904 rains failed in August, were very poor in September and October, and there was an extremely low-stage supply in consequence. With regard to the conditions of atmospheric pressure, to which Dr. Herbertson referred, I hope to publish something about that shortly. We have four years' observations for most stations, and two years for the others, our last station being within about 20 miles of the Uganda frontier. The main changes in the lines of the isobars appear to be, first of all, in the spring months, a low pressure forming over Abyssinia, which may have something to do with the quick advance of the early rains into Abyssinia. I am afraid, as regards the variation of the sharpness of the Nile flood curves, I am not able to give any explanation.

Sir Colin Scott Moncrieff: Might I ask a question? Supposing that the Victoria Nyanza was going down to Khartum, what would be the effect after that fills up the great spongy swamps? Is it not the case that in the month of March it is White Nile water, and not Blue Nile water, one is getting in Egypt?

Captain Lyons: There is a constant supply of about 300 cubic metres per second from the White Nile above the Sobat, plus a certain amount from the Sobat, plus a certain amount from the Blue Nile, and it is the last two factors that vary.

Sir Colin Scott Moncrieff: But the Blue Nile is not very much at that time, is it?

Captain Lyons: In a year of low supply it may discharge in May, but it is usually 300 cubic metres per second in the middle of January.

Sir Colin Scott Moncrieff: I was in Khartum the other day, and there seemed to be nothing at all.

Captain LYONS: In the previous autumn rain in Abyssinia was very deficient; therefore there was nothing to fill up the springs, and the Blue Nile ran down rapidly; the Sobat supplied little, but there was the same constant discharge above the Sobat junction. It is the extra supply that ordinarily comes at the low stage from Abyssinia which decreases in the years when either the whole rainfall has been feeble, or when the September and October rainfall has failed.

Sir COLIN SCOTT MONCRIEFF: The practical question we always wished to solve in Egypt was to find what sort of forecast we could have. As you say, I suppose it will be only by very careful examination of the great territories south of the Victoria Nyanza you will ever get at that.

Captain LYONS: Yes, probably by studying the rains as they extend northwards, together with the meteorological conditions existing over the western part of the Indian ocean.

Sir J. ELIOT: Is the Egyptian Service establishing any rainfall stations in Abyssinia?

Captain LYONS: We have had instruments for two or three years at Addis Abbaba, but they need replacing, and it is difficult to send them there safely. The Russians and the Italians are taking observations there also. Three or four rain-gauges have been sent to other places, but no returns have yet been received.

The PRESIDENT: In proposing a vote of thanks, I wish to say I am not myself a specialist on these points, therefore I can only give an outside view. It seems to me we owe Captain Lyons a debt of gratitude in three ways. In the first place for the positive information chiefly in regard to the real causes of the rise of the Nile, which have been so much in dispute for a long time; in the second place, for the negative portion of the paper, in which he disproves the relation, so far as we can see it, between the sunspot curves and the flood curves; and in the third place, raising the question of any relation between the flood in Abyssinia and the rains in India. I think that will give rise to much discussion. Altogether, I think it has been a most admirable paper, and has given rise to much interesting discussion.

SOME FURTHER NOTES CONCERNING THE LIAO HO.*

By Lieut.-Colonel A. W. S. WINGATE.

MR. ROBERT T. TURLEY contributes to the March number of the *Journal* (pp. 297–300) some interesting "Notes on the River System of the Upper Liao, Manchuria," accompanied by a "Sketch-map of the Liao River System," which, as the author justly says, should be of exceptional interest at the present juncture. With the object of maintaining that interest and of supplementing the valuable information contributed by Mr. Turley, the following notes have been written. Let me begin by calling attention to a few misconceptions in Mr. Turley's notes and map.

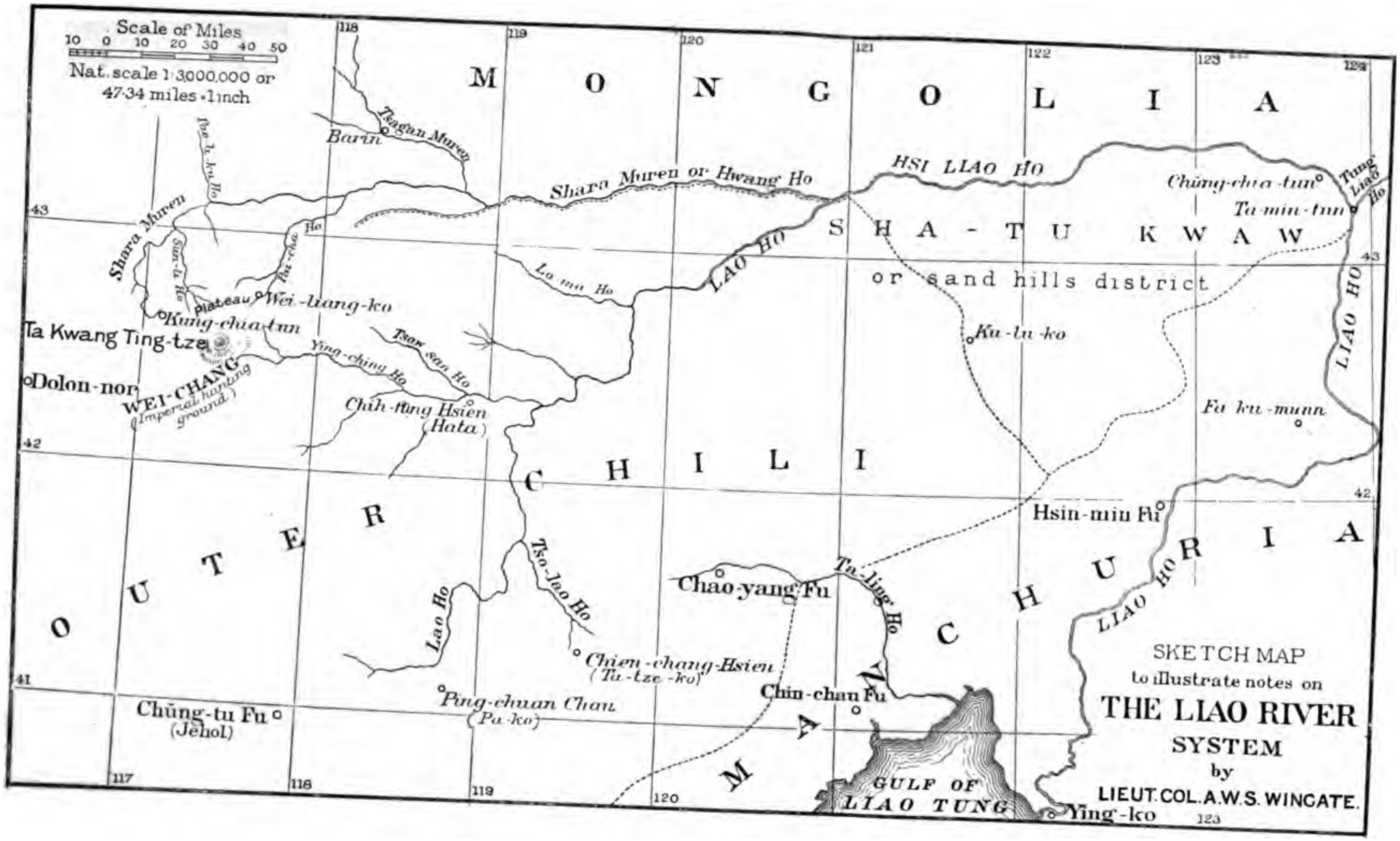
1. First and foremost as to nomenclature. I have been at some pains to discover the true names of the river in question, and my

* The latitudes and longitudes are approximate only, being derived from Russian maps checked by plane-table traverse. The exception is Hata, the data for which were furnished by Major Goold-Adams, R.A.

inquiries have resulted in this: that the Liao Ho (Ho is the Chinese for river) is known by that name only after the union of the Hsi Liao Ho with the Tung Liao Ho (East and West Liao rivers) at a place called Ta-min-tun, about 65 miles a little east of north from Fa-ku-men; this is Mr. Turley's Liao Ho. With the eastern branch I shall not concern myself at present. The Hsi Liao, or Western Liao, is known by that name from the time it leaves Manchuria until its junction with a river of many names and spellings, but known to the local Chinese as the Hwang Ho, and to the Mongols as Shara Muren, both names signifying "Yellow river," after the colour of the water. I shall have more to say about this stream later. From this point (*i.e.* the junction of the above two rivers) our stream becomes the Lao Ho of the Chinese and the Laocha Muren of the Mongols. Thus Mr. Turley's Liao Ho includes the Shara Muren, Lao Ho, Hsi Liao Ho, and Tung Liao Ho, which, all united, form the Liao Ho of Manchuria; the first-named three being in Mongolia and Chili province. It is, therefore, the lower rather than the upper Liao which lies in Manchuria.

2. The headwaters are composed of quite a number of streams, though there are two main sources—the Lao Ho, which rises, as Mr. Turley says, just north of the 41st parallel and just east of the

A PORTION OF THE PAI-CHA PLATEAU, AND SOURCE OF PAI-CHA RIVER.
(*Photo by Lieut. H. J. Doveton.*)


Scale of Miles
10 0 10 20 30 40 50
Nat. scale 1:3000,000 or
47·34 miles = 1 inch
MONGOLIA
SHA-TU KWAW
or sand hills district
OUTER CHILI
MANCHURIA
HSI LIAO HO
Shara Muren or Hwang Ho
LIAO HO
Tsagan Muren
Barin
Shara Muren
Sun-tu Ho
Plateau
Wei-liang-ko
Kung-chia-tun
Ta Kwang Ting-tze
Dolon-nor
WEI-CHANG
(Imperial hunting ground)
Ying-ching Ho
Tsaw san Ho
Chih-fung Hsien
(Hata)
Lo ma Ho
Ku-tu-ko
Fa ku-munn
Ching-chia-tun
Ta-min-tun
Tung Liao Ho
Hsin-min Fu
Chao-yang Fu
Ta-ling Ho
Tso-Jao Ho
Lao Ho
Chien-chang-Hsien
(Ta-tze-ko)
Ping-chuan Chau
(Pa-ko)
Chin-chau Fu
Chung-tu Fu
(Jehol)
GULF OF LIAO TUNG
Ying-ko
117 118 119 120 121 122 123 124
41 42 43
SKETCH MAP
to illustrate notes on
THE LIAO RIVER
SYSTEM
by
LIEUT. COL. A. W. S. WINGATE.

THE NORTHERN WEI-CHANG (IMPERIAL HUNTING-GROUND), SHOWING THE COUNTRY WHERE THE SHARA MUREN AND TRIBUTARIES TAKE THEIR RISE. THE PHOTOGRAPH WAS TAKEN LOOKING NORTH-WEST FROM THE SUMMIT OF TA KWANG TING-TZE, 6000 FEET ABOVE SEA-LEVEL.

(*Photo by Lieut. H. J. Doveton.*)

118th degree of east longitude, and Tso-lao Ho, which begins close to Chien-chang Hsien (Ta-tzu-ko). But the Lao Ho certainly does not derive any water from the "hunting forest near Jehol," for it is separated from the valley of the Je Ho (Hot stream) by a range of mountains which Dr. Franke calls Yung-an or Mu-yu mountains. It would be more accurate nowadays to speak of the Lao Ho as rising in Outer Chili, the time for speaking of any portion of the country lying south of the 43rd parallel as Mongolia, or a land inhabited by Mongols, having long passed away. Outer Chili is to-day as much China as any other part of the eighteen provinces. Its inhabitants differ scarcely at all from those dwelling within the Great Wall; indeed, the north banks of the Shara Muren and Hsi Liao Ho mark the modern southern limit of Mongol territory. Mr. Turley says the Lao (or, as he calls it, the Liao) Ho loses much water "as it wends its way slowly over the plateau." But what plateau? I have always understood that the Mongolian plateau ends with the Hing-an range; but if this be not the case, yet is it misleading to speak of the Sandhills district (Mr. Turley's Sha-tu Kwaw), on the edges of which the Lao

Ho, Shara Muren, and Hsi Liao Ho undoubtedly do lose much water as a plateau.

3. Mr. Turley goes on to say, "Until it enters Manchuria it passes only one town, Bada, a noted barter-market." Now, if Hata or Chih-feng Hsien (its Chinese name) is on the Lao Ho, or the Hsi Liao Ho, or any other river of like name, then every map in existence is wrong! Mr. Turley's map is somewhat out in this direction. The town in question is in lat. 42° 18′ 40″, long. 118° 50′ 30″ E., on the Ying-ching Ho, an important tributary of the Lao Ho, 130 miles long, whose headwaters are to be found in the north of the Wei-chang (Imperial hunting-ground) on the slopes of the very mountain (Ta Kwang Ting-tze, the same, I believe, as Dr. Franke's Tuchte, and not improbably Huc and Gabet's Sain-oula, or Good mountain) which has for centuries formed a kind of will-o'-the-wisp to travellers and sportsmen engaged in looking for Verbiest's and Gerbillon's 10,000 feet high Pai-cha (Pei-sha or Pétcha). I am thankful to say we have at last run that phantom to earth. The region is extremely interesting, not only to geographers and sportsmen, but also to the naturalist and botanist, and merits a paper to itself. Here I will only say that there is not a single peak of the Hing-an range south of the Shara Muren which overreaches 6600 feet above sea-level.

THE SHARA MUREN, ABOUT 30 MILES FROM ITS SOURCE AND 20 MILES ABOVE ITS JUNCTION WITH THE PAO-LI-KU HO, FROM WHICH THIS CLEAR WATER DERIVES ITS YELLOW TINGE. LOOKING EAST DOWN RIVER.

(*Photo by Lieut. H. J. Doveton.*)

THE HWANG HO OR SHARA MUREN 15 MILES ABOVE ITS JUNCTION WITH PAI-CHA-HO. LOOKING WEST UP RIVER.

(*Photo by Lieut. H. J. Doveton.*)

4. Thanks to the "Boxers," our knowledge of these regions is not so "vague and uncertain" as it was prior to 1900. The disappearing rivers are common enough and easily accounted for, but the "intermittent springs" sound interesting, and one would like to hear more about them. The "Ta-miao Ho" is not marked on any map in my possession, but is possibly the Yang-hsi-mu Ho (Dr. Franke's Yang-sheng-mu) with its tributary the Hsiao-shwei Ho. As to "Ku-lor," it is impossible to know which place is meant, as it is not marked on Mr. Turley's map. It may be Ku-lu-Kou, Ku-lien-erh, Ke-li-kê, or a host of similar-sounding places.

5. Certainly the geologist would find much to interest him in the country drained by the Lao Ho and Shara Muren and their tributaries; but I am inclined to doubt the likelihood of a former "highly civilized race" having done much building in these regions prior to the rise of the Manchus to power. Perhaps researches conducted like those of Dr. Sven Hedin in Central Asia might produce something of interest.

6. Mr. Turley thinks "the most northern bend of the Liao, which is formed by the junction of the Lao Ho (Khe) and Sira Muren (or upper Liao), is fully 100 miles due north of the position allotted to it on most maps. . . ." The statement that the Sira Muren is identical with the upper Liao is a geographical error, as, of course, such is not

the case. The Sira Muren (Shara Muren, Shira Muren, Hsi-la-mu-lan, or Hwang Ho) is the most important tributary of the Hsi Liao Ho, and rises on the north-western slopes of the plateau which forms what is generally known as the Pai-cha district. But if we call it by its Chinese name, Hwang Ho, then undoubtedly its source is the Pao-li-ku Ho, which, rising in the hills north of Chin-p'eng, flows south for 25 miles, and then turns sharp to the east on meeting the Shara Muren. The reason for this conclusion is that, above the point of junction the latter river loses its yellow tinge and becomes clear water. The headwaters of the Shara Muren and Sun-li Ho (a branch of equal

THE HSI LIAO HO NEAR CHUNG-CHIA-TUN, AFTER IT HAS LOST MUCH WATER IN THE SHA-TU KWAW (SANDHILLS DISTRICT). BRIDGED BY A SINGLE BOAT. ABOUT 20 MILES DOWN RIVER FROM HERE IT JOINS THE TUNG LIAO HO.

(*Photo by Captain F. E. Gunter, R.A.M.C.*)

BOATS ON THE LIAO HO, WHICH REACH TUNG-CHIANG-TZU

(*Photo by Captain F. E. Gunter, R.A.M.C.*)

THE MANCHURIAN LIAO HO AT YING-KO (TREATY PORT). LOOKING UP RIVER AT SUNSET.

(*Photo by Captain F. E. Gunter, R.A.M.C.*)

length and greater volume) all lie within a day's march of each other in lat. 42° 40′, long. 117° (about). It may be as well to say here, for the benefit of future travellers, that the Dolon Nor and Ch'ang-tu Fu sheets of the new (1904) German 1 : 1,000,000 map are very misleading in a good many places.

Mr. Turley is quite correct in saying that the most northern point touched by the Hsi Liao Ho is shown too far south on the maps of the day. The mistake has arisen from supposing the small stream which joins the Liao Ho about 15 miles north of Fa-ku-munn (shown on Mr. Turley's map, but without a name) to be the real Hsi Liao Ho, which, uniting with the Tung Liao Ho (Mr. Turley's Liu-chia Ho Yen) at Ta-min-tun (lat. 43° 23′), form together the Liao Ho of Manchuria. But Mr. Turley has gone to the other extreme by placing the highest point at 43° 50′, whereas 43° 35′ is about the maximum. In fact, the Shara Muren and Hsi Liao Ho, between E. longs. 118° and 123° 40′, follow, roughly speaking, a course between lat. 43° 15′ and 43° 35′.

Mr. Turley says, "No boats are allowed above Tung-chiang-tzu" (the port of Fa-ku-munn, from which it is distant about 15 miles). This is, I think, not quite accurate. I have heard that fair-sized boats reach Ta-min-tun, 65 miles higher up, and that very shallow boats get 16 miles further, to a point within 3 miles of Chung-chia-tun (lat. 43° 28′ approx.).

7. With respect to the course of the Liao Ho proper, in its passage through Manchuria to the sea, I have nothing to add to Mr. Turley's first-hand information. There are certainly no bridges over these rivers at present existing, though it would be easy enough to make them in certain spots. But that good stone bridges existed at one time

over some of their tributaries, is demonstrated by the artistic photograph in Dr. Franke's well-known work, 'Beschreibung des Jehol-Gebietes in der Provinz Chihli,' of a stone bridge over the Tsagan Muren, a tributary of the Shara Muren which drains the Barin country.

THE FIELD OF GEOGRAPHY AND SOME OF ITS PROBLEMS.*

By Rear-Admiral Sir W. J. L. WHARTON, K.C.B., F.R.S.

It is sometimes denied to Geography that she has any right to consider herself as a science, the objection being apparently founded on the view that it is a subject that can be learnt by heart, but not studied on any systematic line or reduced to principles which enable advance to be made, as in the more exact sciences, by continual investigation by means of laws discovered in the course of such investigation. This, it appears to me, is a misapprehension due to an incomplete recognition of what science is, and of what geography is. Science is, in its simplest interpretation, "knowledge," such knowledge as comes from an intimate acquaintance with and study of any subject duly co-ordinated and arranged. The subjects which the advancing education and civilization of the world have caused to be minutely studied are very many, and as knowledge has increased specialization has become a necessity, until the list of sciences is very long.

Science may be broadly divided into several categories. Pure or Exact Science, such as mathematics; Natural or Physical Science, which rests on observations of nature; Moral Science, which treats of all mental phenomena. Some sciences are of ancient foundation, some have arisen from new inquiries and needs of man, or from fissure in subjects too wide for convenient treatment as one. Many of them are capable of exact definition, and their boundaries and limits can be well marked. To others no very distinct limitations can be assigned. From their nature they overlap and are overlapped by other subjects, and it is impracticable to confine them by a strict line. Geography is one of the latter.

Geography is one of the most ancient subjects studied with a view of co-ordinating facts. A desire for exact knowledge of, first, the bearings and distances of one place from another for the purposes of intercommunication must have arisen as soon as men became collected into groups whose growing civilization and needs required travel to obtain what could not be obtained in the community. This was the earliest form of geography, and it is an aspect which still remains, and to some is, in the modern shape of maps, the principal, if not the sole, end of geography.

From the earliest times, however, geographical information included other than topographical data. It was soon found that for the traveller and statesmen, whether in peace or war, more was wanted to enable geography to supply requirements. The nature of a country, the supply of food and water, the character of the rivers, the manners and customs of the inhabitants, their language and affinities, the climate, and other matters, were all of much moment, and geography dealt with them all, being, as its name denotes, in the broadest sense a "description of the earth."

After the first crude guesses of relative positions, founded on times occupied on journeys, other knowledge was enlisted in the cause. Astronomy

* Presidential address to the Geographical Section of the South African the British Association, Cape Town, August, 1905.

recognized as the only means by which to ascertain the distances of places far apart and separated by seas, but for many centuries this could only be applied to latitude. Still, the scientific geographer had to study and use the astronomical and geodetic methods known. As knowledge increased, the subjects became too wide to be strictly considered as one study, and many have become the objects of special research under different titles.

Geodesy deals with the precise form of the Earth and its dimensions. *Geology* studies the nature of the materials forming the Earth's crust, and the changes in it in past ages. *Ethnology* and *Anthropology* treat of the different races of mankind. The study of *Economics* takes note of the conditions of communities and nations, their laws and systems of government. *Botany* and *Zoology* now concern themselves with the details of vegetable and animal life. *Archæology* investigates the remains of past civilizations which cover the Earth. *Meteorology* strives to unravel and reduce to law the complicated conditions of the atmosphere, its continual movements, and the results which have such varying effect on our daily life. *Oceanography*, the study of the phenomena of the sea as distinct from the dry land, is still regarded as an integral part of geography, but is rapidly becoming a subject by itself.

Of all these subjects geography may be considered to be the parent; and though the family may be large, and has gone off on many separate lines, it is necessary when taking a large and comprehensive view of the united results of knowledge thus gained, especially from the point of view of distribution, to return to that parent and consider them on a general or geographical basis.

I cannot pretend to define Geographical Science in a clearer or shorter form than that in which it has been already put by General Sir Richard Strachey, and I will quote his words:—

"To investigate and delineate the various features of the Earth, to study the distribution of land and sea, and their effects upon climate, the configuration and relief of the surface, positions on the globe, and so forth, facts which determine the existent conditions of various parts of the Earth, or which indicate former conditions, and to ascertain the relations that exist between those features and all that is observed on the Earth."

Strabo, in the opening words of his introduction to his great Geography, puts it thus:—

"If the scientific investigation of any subject be the proper avocation of the philosopher, geography, the science of which we propose to treat, is certainly entitled to a high place. In addition to its vast importance in regard to social life and the art of government, geography unfolds to us the celestial phenomena, acquaints us with the occupants of the land and ocean, and the vegetation, fruits, and peculiarities of the various quarters of the Earth."

This was written when geography included all natural science, and before it gave birth to so many separate subjects; but it sets forth admirably the aims which the geographer still pursues that it is worthy of remembrance. It is not advocated, nor is it in any way necessary, that all should study geography in the extended sense thus indicated; but it cannot be too strongly pointed out that an educated man—and education is now essential to the successful conduct of affairs—must have a considerable knowledge of the elementary facts of geography.

These elementary facts are, it is true, of the nature of a lesson, and must be learnt, so to speak, by heart by the aid of maps and books; but this is nothing more than making use of the labours of others without which no advance is possible in any subject, and is common to all studies. We must, in fact, distinguish between the science of geography, which consists in ascertaining and co-ordinating

Royal Geographical Society.

NATURE AND OBJECTS.

THE ROYAL GEOGRAPHICAL SOCIETY was founded in 1830 for the Advancement of Geographical Science. It received a Royal Charter of Incorporation in 1859.

The Society's affairs are managed through a Council consisting of a President, Vice-Presidents, Treasurer, Trustees, Secretaries and twenty-one other Fellows, elected annually at a General Meeting of the Fellows.

The Society carries out the object for which it exists—

(1) By holding Meetings at regular intervals during the Session (November to June), at which communications are made and discussed by travellers, explorers and geographers, dealing with new discoveries, and with other matters pertaining to the field of geography.

(2) By the publication monthly of the *Geographical Journal*, in which are contained not only the communications made directly to the Society, but articles, notes and correspondence relating to geography and travel all over the world, and also a bibliography of all books, papers and articles dealing with geography published during the month, and lists of all the most important maps issued. The *Journal* is amply supplied with new maps and illustrations. It is sent free to all Fellows.

(3) By the issue of other occasional publications and maps.

(4) By the maintenance of a Library and a Collection of Maps and Photographs. The Library numbers over 50,000 volumes; there are 120,000 maps and 25,000 photographs. The Library and Map Room are open to all Fellows, and there is ample accommodation in the Society's House for reading and research. Each Fellow is entitled to borrow four volumes at a time.

(5) By the assistance rendered by the staff to those in search of geographical information.

(6) By carrying on a system of instruction for intending travellers in various branches connected with geography.

(7) By contributing to the expenses of exploring expeditions, and by lending instruments to travellers who are competent to use them.

(8) By encouraging, directly and indirectly, the improvement of geographical education.

(9) By the award annually of medals and other honours to distinguished travellers and geographers.

His Majesty the King is Patron of the Society, and H.R.H. the Prince of Wales Vice-Patron.

The President of the Society (1905–1906) is the Rt. Hon. Sir George Taubman Goldie, K.C.M.G., F.R.S., D.C.L., LL.D.

Candidates for admission into the Society must be proposed and seconded by Fellows, and it is necessary that the description and residence of such Candidates should be clearly stated on their Certificates.

It is provided by Chapter IV., § 1, of the Regulations, that,

"Every Ordinary Fellow shall, on his election, be required to pay £5 as his "admission fee, and £2 as his first annual subscription, or he may compound either "at his entrance by one payment of £35, or at any subsequent period on the following "basis:—

"Fellows of 20 years' standing and over	.. .. ..	£12 10s.
" 15 " " and under 20	.. .. ..	£16
" 10 " " " 15	.. .. ..	£20

"And no Fellow shall be entitled to vote or to enjoy any other privilege of the "Society so long as he shall continue in arrear."

All Subscriptions are payable in advance, on the 1st of January in each year.

Copies of the Regulations and Candidates' Certificates may be had on application at the Society's House, 1 Savile Row, London, W.

The Society's House is open from 10.30 A.M. to 5 P.M.; on Saturdays to 1 P.M.; and on Meeting nights to 8.15 P.M.

On the Ground Floor of the House are the Offices and Map Room.

On the First Floor the main Library and the Council Room, which is available to Fellows as a reading room when not required for Council or Committee Meetings.

On the Second Floor are the Secretary's Office, the upper Library (fitted up specially for the use of Students), and the Librarian's Room.

On the Third Floor is another portion of the Library, a Smoking Room, a Room for Instruction, the Map Draughtsman's Department, and the Map Mounter's Work Room.

On the Roof is the Observatory.

Full details with regard to the Society, with List of Fellows, &c., are given in THE YEAR BOOK, copies of which may be obtained on application.

SESSION 1905-1906.

PROVISIONAL PROGRAMME.

Ordinary Meetings.

The following are the dates on which the Ordinary Meetings of the Society will be held, at 8.30 P.M., in the Theatre, Burlington Gardens (by permission of the First Commissioner of Works):—

1905.	Monday, November	6, 20	1906.	Monday, April	9	
	" December	4, 18		" May	7, 21	*Anniversary*
1906.	" January	15, 29		" June	11, 18	
	" February	12, 26				
	" March	12, 19				

So far the following arrangements have been made:—

November 6.—Introductory Remarks by the PRESIDENT.
Travels in the Mountains of Central Japan. By the Rev. WALTER WESTON, M.A.

November 20.—First Exploration of the Hoh-Lumba and Lobson Glaciers (Himalaya). By Mrs. FANNY BULLOCK WORKMAN, F.R.S.G.S.

December 4.—Exploration in the Abai Basin, Abyssinia. By H. WELD BLUNDELL.

December 11—Exploration in New Guinea (*with Cinematograph Illustrations*). By C. G. SELIGMAN.

Other provisional arrangements are as follows:—

Unexplored India. By Colonel Sir T. H. HOLDICH, K.C.M.G., K.C.I.E., C.B.

The Economic Geography of Australia. By Prof. J. W. GREGORY, F.R.S.

Survey and Exploration in Seistan. By Colonel A. H. MCMAHON, C.S.I., C.I.E.

Exploration in Tierra del Fuego. By Captain RICHARD CRAWSHAY.

Exploration in the East Tibet Borderlands. By Lieut. FILCHENER.

Explorations in Bolivia and Peru. By Baron ERLAND NORDENSKJÖLD.

The Philippine Islands. By Prof. ALLEYNE IRELAND.

Northern Rhodesia. By L. A. WALLACE.

The Geographical Influences of Water Plants in Chile. By G. F. SCOTT ELLIOT.

Maps of London. By LAURENCE GOMME.

RESEARCH DEPARTMENT:—

On the Next Great Arctic Discovery: The Beaufort Sea. By Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S.

N.B.—Information as to the Society's Meetings, and other matters of interest to Fellows, is given under the head of Notices, on p. iv of the monthly parts of the *Geographical Journal*.

Extra Meetings. When considered necessary by the President and Council, Extra Meetings will be held, and will be announced in the usual way in the *Journal.*

Research Department. In addition to the Evening Meetings, occasional Afternoon Meetings of the Research Department will be held for the discussion of special subjects in Scientific and Applied Geography. Fellows of the Society are admitted to these Meetings; Non-Fellows only by special invitation. Notice of these Meetings will be given on p. iv of the *Journal.*

Anniversary Dinner and Conversazione. The Anniversary Dinner of the Society will take place on the evening of May 21st, 1906. The date of the Annual Conversazione will be announced in due course.

Instructions for Intending Travellers. Details as to the Society's arrangements for instruction to intending travellers can be obtained by applying to the Secretary.

LEONARD DARWIN, } *Honorary*
JAMES F. HUGHES, } *Secretaries.*
J. SCOTT KELTIE, *Secretary.*

1 Savile Row, London, W.
October 1905.

new facts, and putting them into a shape for the use of others, which is the work of comparatively few; and the practical geography which consists of making use of that work, and which, as in many other branches of science, is within the reach of all who choose to devote time to it.

It is the object and business of the British Association to try to interest their fellow-countrymen in all branches of knowledge, to gain if possible more workers in science, but at any rate to induce all educated persons to take advantage of the solid work done by others towards the elucidation of the details of the glorious Nature which surrounds us on all sides, and in so many forms, and without which ignorance and superstition, those primary bars to the advancement of mankind, can never be banished. It is impossible to have a clear comprehension of history whether past or present, without calling in the aid of Geography; but unfortunately much history has been written and taught without such aid. To read the daily paper requires either geographical knowledge or constant reference to maps; and if readers would only make a practice of such reference on every occasion when at fault, they would soon find themselves acquiring knowledge of the greatest use to them in the easiest and most interesting manner, and with the smallest expenditure of time. The mistakes made even by those responsible for the conduct of public affairs, by reason of the want of this essential but elementary knowledge, are innumerable, and to this day there are many who consider themselves highly educated and capable men who cannot even rightly understand a map. As I have before indicated, good maps are the foundation of all sound geographical knowledge, and these maps must be founded on good surveys. Now a good survey is a comparatively modern operation, and the parts of the world that have been subjected to it are small indeed. It is true that we now have general maps of the larger parts of the world, which more or less convey a fair representation of the configuration of land and sea when large areas are considered, but details are sadly lacking almost everywhere. It is not astonishing, for to make the necessary surveys requires an enormous expenditure of both time and money, and the latter is hard to get until the necessity for its expenditure is patent to the smallest intelligence. Thus many countries long settled and in a high state of civilization are still without any organized system of survey or maps, and even in the United Kingdom it is only from the year 1784 that a proper survey was established of the British Isles, though no maps were published from it until 1801; and it has proceeded so slowly that it has only recently been in one sense completed, while its revision, badly wanted on account of changes, is still in active prosecution, and must be continued *ad infinitum*. Such indifference is, however, giving way to experience of the results of absence of proper maps, and all who wish well to the progress of South Africa must be pleased at finding that their provision has been taken in hand on such an admirably scientific basis as is provided by the Trigonometrical Survey, now far advanced, and the successful progress of which is, I believe, greatly due to the inexhaustible energy of my friend Sir David Gill, who seems to find time to promote and aid all branches of knowledge, and that steps are now being taken to prosecute the detailed topographical survey and provide good maps.

To many people one map is as good as another. They do not pause to consider on what it is based, or what degree of accuracy it probably possesses, but so long as there is a map they are satisfied. A vast number of existing maps are compiled from the roughest materials: in partly occupied countries, from drawings of small areas placed together as can best be done, by means of places here and there whose relative positions are fairly known by distances along roads, with perhaps in some cases angles and astronomical positions; in less civilized parts by routes of travellers laid down by estimation of the distance traversed and direction of march, checked perhaps by a few astronomical observations of more or less value as the traveller possesses or does not possess the necessary skill. The compilers of such a map have a difficult task. Discrepancies are, of course, multitudinous. Nothing agrees, and one has to accept, reject, and adjust as best he can on his own responsibility and with what knowledge he can procure of the respective reliability of each author. Happy is he if he has even a few positions in his map which have been properly determined, as between them he is saved from the constantly increasing errors of adding one little area to another, which if carried on indefinitely culminates in great errors. Of course such maps are of no practical use, save as giving a very general idea of a country, and when required by the administrator or traveller lead to endless mistakes and annoyances.

The feature of our globe which is now, broadly speaking, most accurately laid down is the coast-line. The safety of navigation has caused general marine surveys to be carried on all over the world during the nineteenth century, which have finally determined the position and shape of the boundaries of the sea. These surveys, executed for the most part by skilled naval officers with proper instrumental outfit, and supplied especially with reliable chronometers, and based upon frequent carefully determined astronomical positions, have resulted in this boundary line being delineated with an accuracy, so far as its absolute position is concerned, far in advance of any other main feature in maps. Here I may perhaps explain to those unversed in these matters why this is so.

The position of any spot on the earth's surface can be ascertained in two ways: either by careful measurement by means of an accurate system of triangles from another spot already fixed, or by independent observations of the heavenly bodies and calculations from them, which give the precise latitude and longitude of the place. The former is suitable for positions inland, but entails much time and labour, and is only adopted when a perfect map is to be made, for which it is the indispensable foundation. The latter can be carried on from a ship, and under most circumstances only from a ship, because of the limitations of the methods of determining longitudes. Longitude can now be satisfactorily and rapidly ascertained in two ways: by the electric telegraph, or by use of chronometers. The places served by the electric telegraph are still few, and its use is therefore restricted: but the chronometer has been in working use for over a hundred years. This instrument, which is merely a watch of especial construction, will only keep a steady rate when it is undisturbed by irregular shocks or motions. No means have yet been found for transporting a chronometer on land without upsetting its regularity, and therefore rendering it useless; but on board a ship it can be so suspended and stowed as to prevent its being disturbed by any ordinary movements of or in the ship. The accurate time of any place departed from, ascertained by astronomical observations, can therefore be carried about on board ship for considerable periods, and by comparison with the local time, also determined by sextant observations of the heavenly bodies, at any required spot on the coast, the difference of longitude is at once obtained with very small limits of error when a number of chronometers are employed. These two simple yet marvellous instruments, the sextant and the chronometer, have thus placed in the hands of sailors ready means of fixing with great exactitude and celerity the position of selected points on coasts all over the world; and it will be seen that, while the detail of the line of coast between such fixed positions will depend upon the degree of accuracy of the survey or sketch, the general lines cannot get far out, as it is constantly checked at the selected points. It is not claiming too much to say that at the present time very few salient points on the coast-lines of the world are as much as two miles in doubt.

It should be a source of great satisfaction to the Briton to know that both these instruments were devised by Englishmen, John Hadley producing the sextant in 1730, in the form still used, on the basis of ideas formulated by Newton fifty years before; and John Harrison the chronometer in 1736. The latter instrument has undergone modifications in detail, but the principle remains the same. It required seventy years before its value was fully recognized and it came into general use. It is a still further satisfaction to think that it is British naval officers who have made by far the greatest use of them in mapping the coasts of the whole world. Since the time of the great Captain Cook British surveying vessels have been constantly employed in this work, not only in British colonies, but in all parts, aiding and often paving the way for British commerce, and for the men-of-war that protect it.

It is difficult to find coasts of any extent that have not been laid down by British marine surveyors. The whole of Africa has been their work. By far the greater part of America, all the south and east coasts of Asia, Australia, and most of the innumerable islands in all oceans have been fixed and laid down by them. Even in the Mediterranean, till very lately, the charts were mostly founded on British surveys, and the improvements now being carried out by other nations on their own coasts in details required for modern navigation do not materially modify the main shapes and positions formerly determined by the British. It has been, and is, a great work, and I hope I may be pardoned for dwelling on it with pride as the result of the wise administration of the Admiralty for many years, and of the immediate labours of my predecessors as Hydrographer, and as a very great contribution to geographical knowledge, more especially as I do not think that it is generally realized that this great advance in geographic accuracy is due to marine surveyors.

To give an idea of the comparative accuracy of the chronometer method, I may mention that on taking at hazard eleven places distributed all over the world at great distances from England, whose longitudes have been recently determined by means of the electric telegraph and elaborate series of observations, I find that the average distance between the chronometer and the telegraph positions is 700 yards. The shapes of the different continents and the positions of islands as at present on our maps and charts will never be altered except in insignificant degree, and the framework is ready for many years' work of land mapping. It is not to be inferred from what I say that marine surveys are approaching their close. It is far otherwise. The time given to these enormous extents of coasts and seas, and the necessarily small scales on which the surveys have been carried on, have caused them to be very imperfect in all details. Hundreds of rocks and shoals, both stretching from the land and isolated in the sea, have been missed in the course of them, and loss of ships and life on these unknown dangers still continues. With the increase of shipping, increased number of ships of heavy draught, the closeness of navigation due to steam, and the desire to make quick passages, smaller inaccuracies of the charts become yearly of greater importance. As an illustration of the condition of affairs I may mention that in Hamoaze, the inner harbour of Plymouth, one of the headquarters of the British fleet for over 300 years, a small but dangerous pinnacle of rock was only discovered five years ago; whilst numerous other dangers of a similar character have been yearly revealed in close surveys of other harbours in the United Kingdom, supposed to be well examined and charted in the last century. There never was a greater need for close marine surveys of places frequented by ships than now.

It is interesting to look back and see the gradual progress of the delineation of the world, and to mark how very recent any approach to accuracy is. The very earliest maps of any extent of country are unfortunately lost to us. The first man who made a map of which any historical record exists is Anaximander of Miletus, about 600 B.C., but we know nothing of it. A map is mentioned by Herodotus as having been taken in 500 B.C. by Aristagoras of Miletus in the shape of an engraved bronze plate whereon the whole circuit of the earth was engraved, with all its seas and rivers, to influence Cleomenes, King of Sparta, to aid the Ionians against Persia. This was probably the work of Hecatæus, to whom early geography owed much. His works are also only known to us by quotation; but they are especially interesting as containing an early idea of the limits of Africa, which he represents as entirely surrounded by the sea—a circumstance apparently either forgotten or disbelieved in later years. Erotosthenes, 250 B.C., and Hipparchus, 150 B.C., made great advances, and the former made the first attempt to measure the size of the earth by the difference of latitudes between Assouan and Alexandria in Egypt, an attempt which, considering the great imperfection of his means, was remarkably successful, as, assuming that we are right in the length of the stadium he used, he made the circumference of the globe 25,000 geographical miles, whereas it should be 21,600. He also devised the system of meridians and parallels as we now have them; but the terms "latitude" and "longitude," to denote positions on those circles, were introduced by Ptolemy.

The maps of Ptolemy, the great Alexandrian astronomer and geographer of A.D. 150, are the earliest we possess. He drew, besides a general map of the whole known world from the southern part of the Baltic to the Gulf of Guinea, north and south, and from the Canary islands to the China sea, east and west, a series of twenty-six maps of the different parts. Ptolemy's maps, and his method of representing the spherical globe on a flat surface, had a great influence on geography for many years. After his time the Greek civilization waned, and the general decline of the Roman Empire, followed by its disruption by the invasion of the barbarians, closed the course of discovery in all branches of research for centuries. It is not too much to say that for 1300 years no advance was made, and until the commencement of exploration by sea, which accompanied the general revival of learning in the fifteenth century, Ptolemy's maps represented the knowledge of the world. As might be expected, the further he got from the Mediterranean, the greater were his errors; and his representations of Eastern Asia and North-Western Europe are somewhat grotesque, though quite recognizable in the main. Of Africa south of the Equator he knows nothing, and his map of it terminates with the border. This is somewhat remarkable, as I am one of those who firmly believe in the circumnavigation of Africa by the Phœnicians sent by Necho, King of Egypt, in 600 B.C., from the head of the Red sea. As described by Herodotus, the voyage has all the impress of veracity. My personal faith in Herodotus was much strengthened by finding when I surveyed the Dardanelles in 1872 that his dimensions of that strait were nearer the truth than those of other and later authorities, even down to the time at which I was at work, as well as by other geographical tests I was able to apply. When, therefore, he records that the Phœnicians declared that in their voyage they had the sun on their right hand, and says he does not believe it, he registers an item of information which goes far to prove the story correct. Influenced by Hecatæus, who though surrounding Africa by the sea cut it far short of the Equator, Herodotus could not conceive that the travellers had passed to the south of the sun when it was in the southern tropic.

No historical incident has been more discussed than this voyage, commentators varying much in their opinions of its truth. But we have to-day some new facts. No one who has followed the exploration of the ancient buildings in Rhodesia, and considered the information we possess on the early inhabitants of Southern

Arabia, whether we call them Sabæans or Himyarites, can doubt that the former were mainly the work of men coming from Arabia at a very early date, while the period of time necessary to carry out gold-mining operations over the large areas now found to have been exploited must have been very great. It seems strange that no record of the constant voyages to this El Dorado should remain, but the very natural desire to keep lucrative information to themselves is not an unknown thing amongst traders of the present day, while the conditions of society and the absence of written records of South Arabia would make concealment easy. The Phœnicians, an allied race, and the great seafaring trading nation of the Mediterranean, succeeded in keeping the majority of their marts secret, and we have incidents recorded showing their determination not to allow others to follow their steps, while to this day we are very doubtful of the limits of their voyages. It may be considered certain that while we naturally quote Greek historians and geographers as the early authorities for the growth of geographical knowledge, and that the scientific basis for proper maps of large areas was really provided by them, the seafaring nations, Arabians, Phœnicians, and Chinese, knew a very great deal practically of the coasts of various parts of the Old World that were absolutely unknown to the Greeks.

The favourable conditions afforded by those remarkable periodic winds, the monsoons, would in the China sea, Bay of Bengal, and the Arabian sea, naturally facilitate any attempts at extensive sea voyages, and would lead to such attempts under conditions that in the regions of variable winds would be considered too dangerous and uncertain. The fact that the monsoons in nearly every case blow practically parallel to the coasts in opposite directions is a most important factor in considering early navigation. The direction of the wind itself in such cases roughly guides a vessel without a compass, and the periods of cyclones and unsettled weather between the monsoons would soon be noted and avoided, as they are to this day by the Arabs and Chinese, whose vessels, I have very little doubt, have remained practically the same for thousands of years.

The unknown Greek author of that unique and most interesting document, the 'Periplus of the Erythræan Sea,' probably of the first century A.D., describes vessels built without nails, whose planks were bound together by cords, in precisely the same way as many Arab dhows now navigating the Indian ocean. His personal knowledge of Africa evidently ceased at Cape Guardafui, though he gives information gained from others on the east coast as far as Zanzibar, which—or, rather, a part on the mainland near—he describes as the limit of trade to the south. We know that Arabs had penetrated further, but no doubt they kept their knowledge to themselves. These early navigators very probably had charts. When Vasco da Gama first passed along the eastern coast of Africa he found that the Arab dhows had charts. Unfortunately none of them has come down to us, or it would have been interesting to compare them with those of the west coast used by the Portuguese at the time, and which were of the crudest description.

I claim for sailors of all ages that they would be the first to make practical maps of the shape of the coasts. Their safety and convenience demanded it, while it is a far easier task to compile such a picture of the earth from successive voyages along coasts over the sea, where average distances from known rates of sailing and courses from the sun and stars can be more accurately ascertained than from long and generally tortuous land journeys in directions governed by natural features, towns, and so forth. A navigator *must* be a bit of an astronomer. A landsman to this day seldom knows one star from another. It was the sea-charts, or *portolani*, of the Middle Ages that on the revival of learning first gave respectable representations of the shape of the coasts, at a time when the learned monks and others were drawing the most fantastic and absurd pictures which they called maps. At the same time it must be remembered that in all ages and down to the present day pilots, who within a hundred years were usually carried by all ships, even for sea voyages, jealously keep their knowledge largely in their heads, and look upon good charts as contrivances to destroy their profession, and that such charts or notes as they had they would keep religiously to their fraternity.

The Egyptians were no sailors, but we know that they habitually employed Phœnicians for sea expeditions, while we have the historical record of the Old Testament for their employment by David and Solomon for a like purpose in the Red sea, and probably far to the south. It is, therefore, almost impossible to doubt that the Phœnicians were also acquainted with the navigation of the Red sea and east coast of Africa. Such a voyage as that recorded by Herodotus would under these circumstances be far from improbable. The varying monsoons, which had led the Arabians centuries before to get so intimate a knowledge of the east coast as to enable them to find and work the gold-fields, would be well known to the Phœnicians, and the hardy seamen who braved the tempestuous regions lying between Cadiz and Great Britain would make little of the difficulties of the African seas.

The limit of easy navigation from and to the Red sea is Sofala. I do not think that it is too great a use of imagination to suppose that it would be from information received in what is now North Rhodesia that it was learnt that to the westward lay the sea again, and that this led to the attempt to reach it by the south. Once started from the neighbourhood of Sofala, they would find themselves in that great oceanic stream, the Agulhas current, which would carry them rapidly to the southern extremity of Africa. I, as a sailor, can also even conceive that, finding themselves in that strong current, they would be alarmed and attempt to turn back, and that after struggling in vain against it they would have accepted the inevitable and gone with it, and that without the Agulhas current no such complete voyage of circumnavigation would have been made. As Major Rennell in the last century pointed out, once past the Cape of Good Hope, the periodic winds, and over a great part of their journey the currents, would help them up the West African coast; and the general conditions of navigation are favourable the whole way to the Straits of Gibraltar, the ships keeping, as they would do, near the land; but we can well understand that, as recorded, the voyage occupied nearly three years, and that they halted from time to time to sow and reap crops. I should say that it is highly probable that either Simon's bay or Table bay was selected as one of these stopping-places.

No reference to this voyage has been found amongst the hieroglyphic records, and, indeed, so far few such records of Necho, whose reign was not for long, are known; but that it was regarded at the time as historical is evident, for Xerxes, a hundred years later, sent an expedition to repeat it in the contrary direction. This, however, failed, and the unfortunate leader, Sataspes, was impaled on his unsuccessful return. This attempt shows that the greater difficulty of the circumnavigation from west to east, as compared with that from east to west, was not realized, and points to the concealment of any details of the successful voyage.

Of Hanno's voyage from the Straits of Gibraltar to about Sierra Leone, the date of which is uncertain, but from 500 to 600 B.C., we should know little had not good fortune preserved the record deposited in a Carthaginian temple. But the well-known secrecy of the Phœnicians in all matters connected with their foreign trade and voyages would explain why so little was known of Necho's voyage, and our present knowledge of the extensive ancient gold workings of Rhodesia shows how much went on in those times of which we are wholly ignorant.

I have dwelt perhaps too long on this subject, but it has to me a great interest; and as it has not, so far as I know, been dealt with by a seaman who is personally well acquainted with the ways of seamen in sailing ships and with the navigation of the coasts in question, I hope I may be excused for putting my views on record. There are several references in Greek and Latin historians to other cirumnavigations, but none of them can be trusted, and apart from Necho's voyage we hear nothing of the east and south coasts of Africa until the arrival of the Portuguese at the end of the fifteenth century. But they found a thriving civilization along the coast from Sofala northward, Shirazi, Arab, and Indian. Ruins exist in many places which have not yet been properly investigated, and we are quite unable to say from what date we are to place the earliest foreign settlements, nor how many breaks existed in the continuity of the gold-mining, which apparently was proceeding at or very shortly before the Portuguese visit.

After the recommencement of exploration by sea in the fifteenth century, seamen slowly gathered enough information to draw the lines of the coasts they passed along, and in time—that is, by the middle of the eighteenth century—most lands were shown with approximately their right shapes. But of true accuracy there was none, for the reason I have before mentioned, that there was no exact method of obtaining longitude. If we look at a general world chart of A.D. 1755—and to get the best of that period we must consult a French chart—we shall find on this small scale that the shape of the continents is fairly representative of the truth. But when we examine details we soon see how crude it all is. I have compared with their true positions the positions of thirty-one of what may be taken as the fundamental points in the world as given in the larger scaled French charts of 1755, from which the general one is drawn, and I find that on an average they are 48 miles in error. The errors vary from 160 miles to 2 miles. If the delineation of the coast-lines between be considered, the inaccuracies are very much greater.

Very shortly after this date more accurate determinations began to be made. The method of lunar distances was perfected and facilitated by tables published in the various astronomical "ephemerides," and seamen and explorers commenced to make use of it. Still the observation required constant practice, and the calculation, unless constantly made, was laborious, and it was used with complete success by the few. The great Captain Cook, who may be looked upon as the father of modern methods of surveying, did much to show the value of this method; but the chronometer came into use shortly after, and the principal advance in exact mapping was made by its aid, as I have already stated.

There is a vast amount yet to be done for Geography. Until we possess publications to which we can turn for full information on all geographical aspects of things on this globe of ours, there is work to be done. Seeing that our present publications are only now beginning to be worthy of being considered trustworthy for the very small amount of knowledge that we already possess, geographical work in all its branches is practically never-ending.

But of exploration pure and simple very little remains to be done. The charm of travelling through and describing an entirely new country which may be practically serviceable to civilized man has been taken from us by our predecessors, though limited regions still remain in Central Asia and South America of which we know little in detail.

I must except the Polar Regions, which are in a somewhat special category, as their opening-up affords few attractions to many people. But a knowledge of the past history of our globe—fit study for human thought—can only be gained by study of the portions still under glacial conditions. What is there round the South Pole—a continent or a group of large islands? What is going on there? What thickness does ice obtain? Have these regions always been glaciated; and if not, why not? Can we get any nearer the mystery of magnetism and its constant changes by study at or near the magnetic poles? All these and many other scientific questions can only be solved by general geographical research in these regions, and all interested in such questions have been delighted at the recent attempts to gain more knowledge. The object of these expeditions was frankly and purely scientific. All hope of remunerative whale or seal fisheries had been dispelled by the visit of the Norwegian whalers in 1892 to the region south of Cape Horn, and the known general condition of the land forbade any expectation of other profitable industries, unless indeed gold and other valuable minerals should be found, which is always possible. Beyond the fact that exploring expeditions of this character keep alive the spirit of enterprise and bring out the finest characteristics of a race—which is a point by no means to be despised—no immediate practical benefit was to be expected.

Progress under the conditions must be slow, but I think that Great Britain may well be satisfied with the information collected in the Antarctic by Captain R. F. Scott and his gallant companions. The unfortunate detention of the *Discovery* by an unfavourable summer prevented the further coastal exploration which was part of the programme, but gave opportunity for further detailed examination of the inland conditions, which was carried out in defiance of the severest atmospheric and topographical difficulties, and with the greatest zeal and intelligence; and it may be doubted whether Science in the end has not gained more than she lost by the unexpected division of energy. The healthy conditions which prevailed throughout are a standing proof both of Captain Scott's eminent capacity as a leader and of the cheery spirit which animated the whole expedition. The full results of the scientific observations are not yet worked out, and in many cases for a complete appreciation of their bearing they must be compared and correlated with those of the other Antarctic expeditions, but many highly suggestive points have already been revealed. For the first time Antarctic continental land has been travelled over for long distances, and though the actual area of new discovery looks small on a map of the world, the distances covered can only be described as extraordinary, and far exceeding the most sanguine anticipations.

Few who considered the mountainous coast-line of Victoria Land and its complete glaciation, as reported by Sir James Ross from his distant view, thought that it would prove practicable not only to ascend those mountains, but to reach to heights much surpassing them behind. The reason that it proved feasible is that, while there are occasional heavy snowstorms, the annual snowfall is small, and the surface, therefore, is generally unencumbered with soft deep snow. And what did Captain Scott find after his memorable struggle up the glacier through the mountains? An enormous plateau at an elevation of about 9000 feet, nearly level, smooth, and featureless, over which he travelled directly inland for over 200 miles, seeing no sign at his furthest point of any termination or alteration in character. So far as could be seen from other journeys, glacial discharge from this great ice-sheet is very small, and practically it appears to be dead. Its accretion by fresh snowfall is insignificant, while on all sides along the flanks of the coastal mountains there are signs of diminution in the mass of ice.

The great ice-barrier east of Ross island tells the same tale. This magnificent feature presents to the sea a face of perpendicular ice-cliffs varying from 60 to 240 feet in height and 450 sea-miles long. Sir J. Ross mapped its position in 1841, and Captain Scott finds that it has retreated on an average 15 miles, varying much in different parts. Should this rate of retreat continue the whole of this ice-mass, as far as Captain Scott saw it, will have vanished in 1000 years. As the motion of the ice-mass is also about 15 miles to the north in the same time, icebergs covering collectively an area of 450 miles by 30 have been discharged from it in sixty years. Captain Scott travelled over it nearly due south to a point 300 miles from its face, and then saw no sign of its end. It is bordered on its western side by a mountainous coast-line, rising in places to 15,000 feet. He found the ice practically flat and wholly unfissured, except at the side, where its northerly motion, found to be about 130 feet in the month, caused shearing and vast crevasses. All that is known of its eastern edge is that it is bordered, where it meets the sea, by land from 2000 to 3000 feet high, suspected by Ross and verified by Captain Scott. This may be an island, or more probably the eastern side of the great fjord or bay now filled by the barrier.

Captain Scott is of opinion that this great ice-sheet is afloat throughout, and I entirely agree with this conclusion. It is unexpected, but everything points to it. From soundings obtained along the face it undoubtedly has about 600 feet of water under it. It is difficult to believe that this enormous weight of ice, 450 miles by at least 360, and perhaps very much more, with no fall to help it along by gravity, can have behind it a sufficient force in true land glacier to overcome the stupendous friction and put it in motion if it be resting on the bottom. It is sufficiently astonishing that there is force enough even to overcome the cohesion at the side, which must be very great. The flat nature of the bottom of the Ross sea and the analogies of many geographical details in other parts of the world make it most probable that the water under the whole barrier is deep.

A point on which I have seen no comment is the difference in the appearance of the slopes of Mount Terror. Captain Scott found the bare land showing over large areas, but during the two summers of Ross's visit it was wholly snow-clad. Sir Joseph Hooker, the sole survivor of Ross's expedition, when questioned had no doubt on the subject, and produced many sketches in support. This may be due to temporary causes, but all the information collected by the expedition points without doubt to steadily diminishing glaciation in recent times. We have, therefore, this interesting fact, that both in Arctic and Antarctic regions, as indeed all over the world, ice conditions are simultaneously ameliorating, and theories of alternate northern and southern maximum glaciations seem so far disproved. But this does not mean that climatic conditions in the Antarctic are now less severe—probably the contrary. It has been pointed out by many that land glaciation may arise from varied primary causes, but one obvious necessity is that the snowfall should exceed melting and evaporation. It need not be heavy; but if it is, it may produce glaciation under somewhat unexpected conditions. This would entail a vapour-laden air more or less continuously impinging upon the land at a temperature which will enable it when cooled, either by passing over chilled land or when raised to higher regions by the interposition of mountains, to give up its moisture freely. This condition is not fulfilled when the air as it arrives from the sea is already at a very low temperature.

It was my fortune to spend two long seasons in the Straits of Magellan, and I was daily more impressed by what I saw. There you have a mountainous ridge of no great height—very few peaks rising more than 4000 feet—opposed to the almost continuous westerly winds pouring in from the Pacific at a very moderate temperature and charged with much moisture. The result is that in the latitude of Yorkshire every mountain mass over 3000 feet high is covered with eternal snow, and sends glaciers down to the sea. I was convinced by what was going on under my eyes that it only required an upheaval of the land of 2000 feet or so to cover the whole of Patagonia with ice. But then the climate would still not be very severe. The temperature of the wind from the sea would be the same, and such part of it as blew along the channels and on the lower land would moderate the cold caused by the ice-covered slopes. The shores of the whole of Western Southern Patagonia, deeply indented with long and deep fiords, indicate, according to all received views of the origin of such formations, that the land was formerly higher, while signs of glaciation are everywhere present.

The results of geographical research show us that in many parts of the world climate must have greatly changed in comparatively recent times. In the now arid regions of Northern Africa, Central North America, and in parts of Asia there is ample evidence that the climate was in times past more humid. In a remarkable paper on the causes of changes of climate, contributed by Mr. F. W. Harmer to the Geological Society in 1901, and which has not obtained the notice it deserves, it is pointed out how changes in the distribution of the prevalent winds would vastly alter climatic conditions. Like everything else in Nature, and especially in the department of meteorology, these questions are exceedingly complex, and similar results may be brought about in different ways, but there can be no doubt that the climate of South Africa would be greatly modified, and more rainfall would occur, if only the cyclonic storms which now chase each other to the eastward in the ocean south of the Cape of Good Hope could be prevailed upon to pursue a slightly more northerly line, and many obstacles to the agricultural prospects of South Africa now existing would be removed. This is, however, beyond the powers of man to effect; but, as I have just said, there are other ways of attaining the object, and it is earnestly to be hoped that the attention now being paid to afforestation may result in vigorous efforts to bring about by this means the improvement in humidity so much required in many parts of the country.

The other recent event in geographical exploration is the result of the expedition to Lhasa. It was an unexpected solution of this long-desired knowledge that it should come from political necessities and by means of a Government mission. The many ardent travellers who have dreamed of one day making their way in by stealth have thus been disappointed, but our knowledge is now fuller than could otherwise have been gathered. The most important fact is the revelation of the fertility of a large part of Southern Tibet. Much has been added to topographical knowledge, but the route-maps of the secret Indian native surveyors already had given us a rough knowledge of the country on the road to Lhasa. It was not, however, realized how great was the difference between the aridity of the vast regions of the north, known to us from the travels of men of various nationalities, and the better-watered area in the south, though from the great height of the plateau—some 12,000 feet—the climate is very severe. The upper course of the Brahmaputra has been traced by Captain Ryder, but, unfortunately, a political veto was placed on the project to solve the interesting problem of how this great river finds its way to the Indian plains, and this still remains for the future to unravel.

Of the ocean, which has been my own particular study for many years, and on which alone I feel any special qualification to speak, I have said but little, for the reason that when presiding over this section on a former occasion I took it for my theme, but there are a few points regarding it which I should like to bring to your notice.

It is of the ocean, more than of any other physical feature of our globe, that our knowledge has increased of late years. Forty years ago we were profoundly ignorant even of its depth, with the exception of a few lines of soundings then recently taken for the first submarine telegraph cables, and consequently we knew nothing of its real vast bulk. As to the life in it, and the laws which govern the distribution of such life, we were similarly ignorant, as of many other details. The *Challenger* expedition changed all this, and gave an impetus to oceanographic research which has in the hands of all nations borne much fruit. Soundings have been obtained over all parts of the seas, even in the two polar seas; and though much remains to be done, we can now form a very close approximation to the amount of water on our earth, whilst the term "unfathomable ocean" has been shown to have been based on an entire misconception. Biological research has also revealed a whole world of living forms at all depths of whose existence nothing was known before.

In my former address, eleven years ago, I gave many details about the sea, of which I will only repeat one—which is a fact that every one should know—and that is, that the bulk of the ocean is about fourteen times as great as that of the dry land above water, and that if the whole of that land were thrown into the Atlantic ocean it would only fill one-third of it. Eleven years ago the greatest depth known was 4700 fathoms, or 28,000 feet. We have since found several places in the Pacific where the depth is nearly 5170 fathoms, or 31,000 feet, or somewhat higher than Mount Everest, which has been lately definitely shown to be the culminating point of the Himalayas. These very deep parts of the ocean are invariably near land, and are apparently in the shape of troughs, and are probably due to the original crumpling of the Earth's surface under slow contraction.

The enormous area of the sea has a great effect upon climate, but not so much in the direct way formerly believed. While a mass of warm or cold water off a coast must to some extent modify temperature, a greater direct cause is the winds, which, however, are in many parts the effect of the distribution of warm and cold water in the ocean perhaps thousands of miles away. Take the United Kingdom, notoriously warm and damp for its position in latitude. This is due mainly to the prevalence of westerly winds. These winds, again, are part of cyclonic systems principally engendered off the coasts of Eastern North America and Newfoundland, where hot and cold sea-currents, impinging on one another, give rise to great variations of temperature and movements of the atmosphere which start cyclonic systems travelling eastwards. The centre of the majority of these systems passes north of Great Britain. Hence the warm and damp parts of them strike the country with westerly winds, which have also pushed the warm water left by the dying-out current of the Gulf Stream off Newfoundland across the Atlantic, and raises the temperature of the sea off Britain. When the cyclonic systems pass south of England, as they occasionally do, cold north-east and north winds are the result, chilling the country despite the warm water surrounding the islands. It only requires a rearrangement of the direction of the main Atlantic currents wholly to change the climate of Western Europe. Such an arrangement would be effected by the submergence of the Isthmus of Panama and adjacent country, allowing the equatorial current to pass into the Pacific. The gale factory of the western Atlantic would then be greatly reduced.

The area south of the Cape of Good Hope is another birthplace of great cyclonic systems, the warm Agulhas current meeting colder water moving up from the Polar regions; but in the southern ocean the conditions of the distribution of land are different, and these systems sweep round and round the world, only catching and affecting the south part of Tasmania, New Zealand, and Patagonia.

In 1894 I spoke of the movements of the lower strata of water in the sea as a subject on which we were only beginning to get a little light. Since that year we have learnt a little more. It is a common idea that at the bottom of the sea all is still; but this is a mistake, even for the deepest parts, for the tidal influence reaches to the bottom and keeps every particle in motion, though such motion is quiet and slow. Near the shore, however, though still in deep water, the movement may be considerably increased. Cases have occurred in late years when submarine cables have broken several hundred fathoms deep, and when picked up for repair it has been found that the iron wire covering has been literally rubbed away as by a file. This can only be the result of an undercurrent along the bottom moving the cable to and fro. Such a current might be caused by a submarine spring, for there is no doubt that much fresh water finds its way into the ocean in this fashion, but it is more probably generally an effect of acceleration of the tidal movement due to the rising slope of the continent. In connection with this, further facts have come to light in the course of recent marine surveys. Many isolated shoal spots in the great oceans have figured in our charts, the results of reports by passing ships who have said they have seen breakers in fine weather. Such places are the terror of seamen, and it is part of the duty of surveying ships to verify or disprove them. Very much has been done in the last eighteen years, with the result that the majority of them have, as dangers, disappeared. In many cases, however, a bank has been found, deep in the ordinary acceptation of the word, but much less deep than the surrounding sea—solitary ridges, in fact, rising from the ocean floor. Frequently, in examining these banks in search of shoaler spots, breakers have been reported and recognized as such on board the surveying ship from a distance, but on approach they have proved to be small overcurls caused by tide ripplings, and the depth of water has proved to be several hundred fathoms. These ripplings are clearly caused by the small tidal motion in the deep water, generally in these cases of over 2,000 fathoms, meeting the slope of the submerged mountain range, being concentrated and accelerated until the water finally flows up the top of the slope as a definite current, and taking the line of least resistance, that to the surface, makes itself visible in the shape which we are accustomed to associate with comparatively shallow water. These cases form remarkable instances of the manner in which extensive motion of water may arise from very small beginnings.

An observation I was anxious to make in 1894 has been successfully carried out since. This was to ascertain whether there was any permanent undercurrent in the Straits of Bab-el-Mandeb due to more water being forced through the strait on the surface by the persistent south-east wind of winter than could be evaporated in the closed Red sea. Such return undercurrents have under somewhat similar circumstances been shown to exist in the Dardanelles, Strait of Gibraltar, and in the Suez Canal. The observation at Bab-el-Mandeb was difficult. The wind is strong and the disturbance of the sea is considerable, while the water is 120 fathoms or 700 feet deep. But a surveying vessel maintained herself at anchor there during four days, and, by the aid of an ingenious apparatus sent from England for the purpose, clearly proved the existence of a current of 1¼ knot flowing steadily at depths below 70 fathoms out of the Red sea, whilst in the upper strata there was a similar current flowing in. In such ways is interchange of water provided for by nature in places where tidal action does not suffice.

In what I fear is a very discursive address I have not mentioned the interior of Africa. In the first place, it is a subject of itself; and as we shall have, I hope, many papers on African subjects I have thought it better to deal mainly with generalities. Still, I cannot refrain from a few words to express the astonishment I always feel when I hear people complain that Africa goes slow. When I look at what has been effected in my own lifetime, it appears to me that, on the contrary, it has been rushed. The maps I learnt from as a boy showed the whole interior as a blank. There are now no parts that are not more or less known. The great lakes have all been revealed; the great rivers have all been traced; Europeans are now firmly fixed with decent governments in parts formerly a prey to tribal wars and the atrocities of the inland slave traffic. Railways are running over regions unknown forty years ago, and one of the most astonishing things to me is that I should be able to hope now to visit in comfort and luxury the Great Victoria Falls which my old friend Sir John Kirk—whom I left the other day hale and hearty—was, with the exception of Livingstone, the first white man to see, after a long and laborious journey in his company in 1860.

I could not help being amused as well as interested at seeing a short time ago a proclamation by the Government of Northern Rhodesia, dated not far from Lake Bangweolo, calling on all concerned to observe neutrality during the present war between Russia and Japan. I think that if anyone had prophesied to Livingstone, as he lay in 1873 lonely and dying by the shores of that newly discovered lake, that such an edict would be issued in thirty years he would have expressed a doubt as to its fulfilment.

To Southern Africa nature has denied two of the features that facilitate rapid progress—good harbours and sufficient rainfall—but the energy of man has done wonders to provide the former where possible, and will doubtless do more; whilst I believe that the lack of the latter will also be overcome in the same way. The co-ordinated—or, in other words, the scientific—observations made in many other countries have pointed out a possible solution. On the other hand, the height of the inland plateaux makes it possible for the white man to live and work in latitudes which would under other conditions be tropical. South Africa must have a great future before it; and while some present circumstances may delay development of its natural advantages, I am inclined to think that in the long run prosperity may be more solid and material for being made in the face of difficulties, as has so often occurred in the history of the world.

REVIEWS.

EUROPE.

NEOLITHIC MAN IN ENGLAND.

'Neolithic Dew Ponds and Cattleways.' By Arthur John Hubbard, M.D., and George Hubbard, F.S.A., F.R.I.B.A. London: Longmans. 1905. Large 8vo. Pp. 71. *Illustrations. Price 3s. 6d. net.*

THE authors give a detailed description of the various prehistoric earthworks and other remains to be seen on the Downs of Sussex and Dorsetshire, especially those associated with the well-known Chanctonbury and Cissbury rings near Worthing, and Maiden Castle near Dorchester. They make the attempt to correlate the various remains, and to explain the uses or objects of the different features; and though, in so doing, they must necessarily fall back in many cases on hypothesis, they piece together such evidence as exists in a way which is certainly plausible, and helps us to realize the probable mode of life of the old inhabitants of these places of refuge of the remote past. After pointing out the difficulty entailed by water-supply on these upland regions, they suggest that these could only have been got over by the use of "dew-ponds" such as still exist on the downs, the traces of earthworks in their vicinity fully bearing out the idea that some of these date from neolithic times, and were included in the general scheme of fortification, which provided for the safe passage of cattle to and from these drinking-places. The authors also adduce evidence to show that some of the old cattle-tracks visible on the Downs date from the same period, being in clear relation with the other neolithic remains. The book is excellently illustrated by photographs, but the want of plans showing the mutual relations of the features described may be felt as a drawback by those not familiar with the localities.

AFRICA.

Barotseland.

'In Romotest Barotseland.' By Colonel C. Harding, C.M.G. London: Hurst & Blackett. 1905. Pp. xvi. + 414. *Map and Illustrations. Price* 10*s*. 6*d*. *net*.

In a volume of some 400 pages, Colonel Harding, Commandant of the Barotse Native Police, gives a readable account of travels undertaken in the course of duties which led him through some of the less-known parts of Lewanika's "empire." The record of distances travelled over, giving as it does a monthly average of 350 miles, inclusive of rests, is one of which the author may justly be proud, especially when it is considered that the time occupied included the whole of one and the greater part of a second rainy season.

The book is subdivided into four parts. Part i. describes a journey up the Zambezi; a short sojourn at Kakengi's, at that time the home of one of the most disreputable debauchées in Africa, and the site of a Portuguese fort; a visit to the Zambezi source, of which a terse and accurate description is given; and thence overland to Nyakatoro, under circumstances calling for the best qualities of the British explorer. Part ii. traces the journey from Nyakatoro westwards to Chisamba, along the route followed by Livingstone, Cameron, Arnot, Quicke, and others, and thence back to Lialui over the southern trade route. Part iii. takes us down the Zambezi to the Victoria falls, and thence to the Kafue-Zambezi confluence, and back to Lialui. Part iv. describes a visit to the source of the Kabompo, which was discovered, located, and fixed by the Belgian explorer Lemaire in the year previous. The book terminates with a short description of Lewanika's visit to England on the occasion of King Edward's coronation.

The book is written in a light vein, and is never dull reading. Its interest is enhanced by the fact that a fair proportion falls in districts hitherto visited only by one or two previous explorers. Perhaps Colonel Harding is somewhat too prone to "discover" points of interest already discovered, fixed, and described. For instance, we read of the "discovery of the source of the Zambezi;" of "the source of the Kabompo, which up to that time had not been located;" and "though some of Major Gibbons' parties explored a portion of the Kafue, I know of no white man who has previously viewed this scene" (the Balungwe rapids). A glance at authentic maps compiled by this Society, the Military Intelligence Division, or the British South African Company, from work achieved by different explorers prior to the author's experience would doubtless have led to modifications in the text here and elsewhere. At the close of Part i. Colonel Harding remarks, "Our observations, especially for latitude, have been most carefully made and repeatedly checked." The results might with advantage have been given in the book, while the addition of a more adequate map would have been useful as a guide to future travellers, to whom it is often a great convenience to know the exact position of places *en route*. The book is, however, an interesting record of travel, in which the author shows zeal, energy, and resource of a high order.

Colonel Harding is at his best in his descriptions of contact with local natives. The occasional glimpses we are given of native customs and character convey a correct impression, and make us wish that the author had enlarged further on the subject, for although the tribes visited have been previously discussed, much has yet to be learned of this interesting Bantu group. Many years will not of necessity elapse before it will be impossible to produce a photograph so typical and grotesque as that facing p. 348; so too with tribal customs. The vandalizing energy of the British settler rapidly obliterates native distinctions and idiosyncrasies.

On p. 118 the author gives quite a new version of the origin of the Barotse and Valovale, which he claims to be "according to the most reliable testimony procurable." To claim credence for a version so entirely at variance with previous research by such authorities as the late Mons. Coillard and others of widespread experience, some argument or reason should be forthcoming. The claim of Nyakatoro to blood relationship with Lewanika does not supply proof positive that their respective tribes are related. African relationships, even "blood relationships," are proverbially vague. Be this as it may, in the face of more logical theories, it is impossible to conceive that the Barotse and Valovale spring from the same stock. In type, language, customs, religion, and character the two tribes have nothing in common. Then we are told that "whilst Nyakatoro was building up the constitution of the Valovale country, Murambo and his son Litia . . . were living in the Barotse country," etc. Murambo died over three-quarters of a century ago, Litia (Lewanika's father) being a small boy at the time. Although Nyakatoro, for an African, is a very old woman, she was probably yet unborn, much less was she making history, at the time referred to.

Colonel Harding does good service in once more emphasizing the appalling extent to which the slave-trade is exploited for the benefit of the Portuguese colonies. As far as Bihe he bears out the late Major Quicke's evidence in detail, though the latter officer was able to trace it onwards to the port of Benguella. Here are some extracts: "John tells me that at a kraal on the Kabompo he saw slaves with yokes and shackles lying prostrate outside their huts. . . . We found lots of stakes and yoke-sticks forked and bored, through which a stick or chain is inserted to keep them on their victim's neck." "Every day I see signs of the slave-trade, the trees literally hung with the shackles which are used to put the hands of the slaves in at night. . . . These are left behind, often on the corpse of its unfortunate prisoner." "The wayside trees are simply hung with disused shackles . . .; skulls and bones bleached by the sun lie where the victims fell, and gape with helpless grin on those who pass, a damning evidence of a horrible traffic." "Other remains are found; here the skull is battered in by the trader's axe, and the body clearly exhibits signs of the greatest torture and pain in the throes of death."

A. St. H. Gibbons.

AMERICA.

The Bahama Islands.

'The Bahama Islands.' Edited by G. B. Shattuck, PH.D., Associate Professor of Physiographic Geology in the Johns Hopkins University, Baltimore. New York: The Macmillan Company. 1905.

This is a monograph containing the results of the labours of a scientific expedition composed of twenty-five members sent out by the Geographical Society of

Baltimore on June 1, 1903. The expedition had only five weeks on the islands for actual work, but during that time "visited Abaco, New Providence, Andros, Green Cay, and the Eleuthera group of islands, Cat island, Rum Cay, and Watlings island," and different members of it made minute investigations with regard to the geology, tides, terrestrial magnetism and climatology, soils, botany, mosquitoes, fishes, batrachians, reptiles, mammals and birds, the sanitary conditions of the islands, and the pathological condition of its inhabitants. On all these subjects detailed reports are given, copiously illustrated by photographs, coloured plates, diagrams, and maps. A history is added extending over 168 pages, and that is followed by a concluding chapter by the editor, containing some general considerations with regard to the economic and social condition of the people. Obviously the work will be of value chiefly to specialists, but it may be of more general interest to mention the conclusion arrived at by the geologists of the expedition with regard to the topographic history of the islands. Dr. Northrop, in 1890, had found evidence of recent elevation in the islands, while Prof. Alex. Agassiz, in 1893, considered that subsidence satisfactorily explained their present configuration. The geologists of the present expedition believe that there was a period when the islands stood at least 300 feet higher than they do at the present time, and that then the limestone rock of which they are composed was dissolved into caverns and grottoes, that a period of depression followed, during which the land sank at least 15 feet lower than the level now occupied, giving opportunity for the formation of the deposits bearing marine shells and the coral reef on Green Cay, and for the cutting of the ancient sea-cliffs, and that this was followed by a rise to the present level. To determine whether this level is now in process of change, and in what direction, bench-marks, which are fully described in the volume, have been erected at Nassau. G. G. C.

Great American Explorers.

'History of the Expedition under the Command of Captains Lewis and Clark.' With an Account of the Louisiana Purchase by Prof. John Bach McMaster. *With Illustrations and Maps.* 3 vols. *Price* 10*s.* 6*d. net.*

'Narratives of the Career of Hernando de Soto in the Conquest of Florida.' Edited with an Introduction by Edward Gaylord Bourne. Illustrated. 2 vols. Sm. 8vo. London: D. Nutt. 1905. *Price* 7*s.* 6*d. net.*

These form the first volumes of a series of reprints of narratives of American travel published originally in the United States, and re-issued in this country by Mr. Nutt, under the title 'Great American Explorers.' They are intended rather for the general public than for students, and the moderate price and handy form in which they are presented render them very suitable for this purpose. The popularizing of standard works like the Lewis and Clarke narrative is a distinct service to geographical history, for it is to be feared that the doings of many of the great travellers of the early modern period which aroused the emulation and spurred the energies of their successors in the middle of the nineteenth century, have become far less familiar to the present generation than they deserve to be. Such a series has long been a desideratum, for while the original works may be accessible to students in geographical libraries, their increasing rarity, and to some extent, also, their ponderous size, have put them out of the reach of the ordinary reader. The enterprise might well be extended in course of time, so as to embrace other parts of the world, the American field having within the past few years been worked with considerable energy on the other side of the Atlantic, whereas, apart from isolated reprints and a few of the volumes of the "Minerva Library," the modern pioneer travellers in Asia, Africa, and Australia have received comparatively little attention.

Of the two famous expeditions dealt with in the present volumes, that of Lewis and Clarke, after being neglected for nearly a century, has given rise to what might almost be called an epidemic of publishing activity within the past few years. A certain amount of the energy thus put forward may no doubt be regarded as wasted, so many independent enterprises having been devoted to one and the same object. The present reprint has, however, the advantage in the lightness and handy form of the volumes, a point of no little importance, in view of the demands upon space made by the flood of modern geographical literature. Like Prof. Hosmer's edition of 1902 (*Journal*, vol. 21, p. 573), it reproduces the narrative prepared by Biddle and published in 1814. Whatever disadvantages this may have had as a compilation, as compared with the actual records kept by the explorers (which of course formed its basis), there is no doubt that it is the most suitable for general use, by reason of its relative conciseness and connected nature. Reduced facsimiles of the original maps and portraits are also given, and there is a brief introduction on the Louisiana purchase by Prof. J. B. McMaster, while explanatory notes on the several sections of the route are prefixed to each volume.

The other two volumes are in some ways of greater original value, for in spite of the many writers on American history who have touched upon De Soto's romantic adventure, no very accessible collection of first-hand authorities was previously in existence. The volumes are edited in a scholarly way by Prof. E. G. Bourne, who gives a clear introductory sketch of the literary material available. The collection of documents is the most complete yet issued in English, and includes the first English version ever given of Oviedo's account, based on the diary of Rodrigo Ranjel, De Soto's private secretary, which had not become generally known at the time the Hakluyt Society's edition of De Soto was issued (1851). While this reproduced Hakluyt's translation of the narrative by the "Gentleman of Elvas," the present edition follows the version of Buckingham Smith, the nineteenth-century English of the latter being thought more suitable for present-day readers. The same writer's version of Biedma's relation is also utilized. Altogether the volumes form a useful addition to the literature of the subject, the only cause for regret being, perhaps, that doubtful questions in regard to the route followed are not more fully discussed by the editor.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

A Classical Atlas.

'Murray's Small Classical Atlas.' Edited by G. B. Grundy, M.A., D.LITT. London: Murray. 1904. *Price 6s.*

It is clear that in the immediate future classical teaching will occupy itself with the subject-matter of the Greek and Latin authors even more than with their language. For such study 'Murray's Small Classical Atlas' affords considerable assistance, as much indeed as its size, cost, and purpose would fairly permit. The separate maps have already been noticed, as they appeared, in previous numbers of the *Journal*; it only remains, therefore, to deal with the Atlas as a whole. Its clearness is a great merit. Coloured contours indicate the natural features of the country; the lines which usually mark the boundaries of provinces are absent, so that the names of places and the main roads stand out with distinctness. The absence of the boundary-lines has, moreover, this advantage: the boundaries are often conjectural and varied from time to time, and the attempt to give them precisely once and for all was misleading to beginners. The only suggestion we have to make on this head is that an extra contour should be introduced into the map of Asia Minor. For the other maps it does not matter seriously, if it matters at all, but so much of Asia Minor lies between 3000 and 9000 feet above the sea that, by the absence of indications of height between these altitudes, the effect of the physical features of the country on its history is somewhat obscured. The addition of one, or at the most two, of the contours given in the corresponding Handy-map would completely meet the case. The editor is, we believe, justified in claiming for the Atlas that it contains all the names necessary for ordinary classical study, and as a rule—if not always, probably in all important cases—sites not fixed with certainty are indicated. It also contains, we believe, the maps generally necessary for that purpose; and here maps ix., xi., and xiii., which contain small maps of Rome, Athens, and other places, chiefly battlefields, are a great gain. It is a pity that the name of each map is not given on the blank page which precedes it, but any one can insert the name for himself, and no one who has used the maps for teaching schoolboys or undergraduates will fail to appreciate their value.

H. C.

GENERAL.

More Columbus Literature.

'Etudes critiques sur la vie de Colomb avant ses découvertes.' Par Henry Vignaud. Paris. 1905.

'Nuevos Autografos de Cristobal Colon y Relaciones de Ultramar; los publica La Duquesa de Berwick y de Alba.' Madrid. 1902.

In the first-quoted work M. Vignaud continues his Columbian researches with a series of six studies, devoted respectively to the family and descent of the discoverer, the two piratical "Colombos" (Guillaume de Casenove and Georges de Bissipat), the date of the birth of Christopher, his education and earliest voyages, and his settlement and marriage in Portugal. The author, as he has shown in previous works, considers that the tradition of the explorer's early life, as given us in Christopher's own letters, in the 'Historie' of Ferdinand Columbus, and in the 'Historia' of Las Casas, is on the whole fabulous and fabricated, with a view to suggesting an illustrious origin and youth for one who was essentially a man of the people. M. Vignaud disclaims the presentation in this volume of new material ("ceux qui ouvriraient ce livre y chercher des documents inconnus ou des faits que personne n'a mentionnés, peuvent donc le refermer"); what he does claim is a fresh presentation of the subject, according to the light hitherto obtained ("des faits qu'ils croyaient bien connaître se présenteront à eux sous un aspect tout autre que celui sous lequel ils les voyaient; d'autres auxquels ils n'avaient attaché qu'une importance secondaire prendront une signification particulière, et des assertions qu'ils s'étaient habitués à tenir pour certaines leur apparaîtront, les unes comme douteuses, les autres comme nettement controuvées"). M. Vignaud has made a very careful, detailed, and suggestive examination of Columbus's early life, in which a certain element of untrustworthy tradition has been recognized by the most competent students at least since the publication of Harrisse's 'Fernand Colomb.' His main conclusions are the following: (1) Christopher Columbus did not belong to a family of navigators, as he himself assures us ("comme il l'assure"), nor to a noble house, as his son declares ("comme le dit son fils"); his parents and all his near relatives, like himself, were weavers. (2) There were never any "admirals" in Christopher's family, as he alleged, and as Las Casas and his son Ferdinand maintained after him. The two "Colombos" with which the Columbian tradition associated his family were of totally different origin, the one a Frenchman, the other a Greek, who became a French citizen. (3) Christopher himself was born in 1451, not in 1435 or 1436, nor in 1446 or 1447, as commonly supposed. (4) Christopher was never at any university, neither at Pavia, where Las Casas and Ferdinand assure us he was sent to study, nor any other. On the contrary, he received the ordinary education of an artisan's child. (5) He did not, at the age of fourteen, as he tells us, give up other professions or prospects for a life absolutely devoted to seafaring; at twenty-two he was still following the trade of a weaver at Savona, near Genoa (apparently after a certain interval of maritime experience), and even after this he appears to have joined with his father in keeping a tavern. (6) He did not go to Portugal in 1470, as one might infer from some of his statements, but in 1476. (7) He did not sail to Iceland "and beyond," at any time, as he declares. All details given of this furthest north are obviously invented. (8) He only settled in Portugal in 1477, being then some twenty-six (or at the most twenty-seven) years old; he was not then a mariner of any great experience, and there is no sufficient reason to believe that he had then turned his attention to scientific geography or trans-Atlantic enterprise. (9) He never fought for King Réné; at the time when, as he says, he commanded a warship in the service of that sovereign, he was only twenty-one, and was still following his weaver's craft.

On the other hand, it is maintained in these 'Etudes' that Columbus may be credited with a true suggestion in so far as the making of some Mediterranean voyages from the age of fourteen, or thereabouts, is concerned; it is not disputed that he then developed a great taste for a maritime life; but it is contended that in 1470, when about nineteen, he was engaged in trade at Genoa, that in 1472 he was certainly pursuing a weaver's life in that city, and that in 1473 he is with equal certainty to be fixed in Savona, where also, in all probability, he was engaged in his weaving business. From this time, all trace of him is lost in Italy, and his name disappears from the notarial records of Genoa and Savona; but it is suggested that in 1474–5 he went to Chios with some Genoese ships, two of which were commanded by Genoese captains (di Negro and Spinola), who are indubitably to be found associated with him in later time. In Chios he probably stayed some time, M. Vignaud allows, for his observations on the mastic trade of the island argue a pretty detailed knowledge.

Once more, Christopher Columbus was unquestionably present at the naval battle of August 13, 1376, when Guillaume de Casenove, surnamed "Coullon" (one of the two piratical "Colombos" above referred to), in command of a mixed Franco-Portuguese fleet, attacked near Cape St. Vincent four Genoese vesels, two of which were the ships of di Negro and Spinola. The latter, escaping from the fray, brought Columbus to Lisbon, and after a stay of some months in this port, left it for England in December, 1476. With them again, it is allowed, Christopher probably went. Both Bristol and Galway are here reckoned among the places genuinely visited by the explorer, following indications given us by himself; and it is considered probable that this assertion of having been in "the North" in February, 1477, is so far true that at this time he made a voyage among the islands lying off Britain.

Those of us who have previously found themselves unable to agree with certain conclusions of M. Vignaud in his 'Lettre et Carte de Toscanelli sur la route des Indes par l'Ouest,' may fairly recognize in this volume a body of carefully sifted historical fact, presented with great clearness, and on a great number of points at least appealing strongly to one's judgment as adequate and correctly viewed. It is obvious, at the same time, that many of the inferences drawn will be considered by some to be of a highly controversial character; and those who have studied the question know that such points as the 1451 birth-year (even though appearing to have excellent support from the best evidence) are not likely to be accepted by "conservatives" without such complete demonstration as to put the matter out of the reach of argument.

The interesting publication of the Duchess of Berwick and Alva contains, among other specimens of Columbus's writing, a sketch of part of the coast of Hispaniola, drawn by him in 1492; it also gives the text of various autograph letters of the Admiral to his son D. Diego and to Fr. Gaspar Gorricio; a list of the companions of the discoverer on the first voyage; a list of various (seventy-eight) important documents relating mainly to the Spanish possessions in America, with copious extracts from some of these; forty-three "Relaciones de Ultramar" (*textos y extractos*) bearing principally upon the East Indies; and similar selections especially concerned with Yucatan and the Philippines. There is much that will be found useful to historical students in these collections, but they appear rather a heterogeneous and bewildering mass as they are presented to the reader. The phototype reproductions are very good and clear (specimens of Columbus's writing and his sketch of Hispaniola, facing pp. 5 and 7; and a sheet of the 1568 atlas of Vaz Dourado, preceding p. 125).

C. R. B.

THE MONTHLY RECORD.

EUROPE.

The Earthquake in Italy.—At about five minutes to three o'clock on the morning of September 8 a destructive earthquake occurred in the province of Calabria. The centre of maximum violence, according to the Central Meteorological Bureau, as reported in the *Times*, was in the neighbourhood of Monteleone, the shock seems to have caused damage to buildings at a distance of 25 miles, and the most distant place where it is reported to have been felt was Bari, about 175 miles from Monteleone. From this it will be seen that the earthquake covered ground which was made classic in seismology by the great earthquake of February 5, 1783, and many of the places destroyed or damaged by the late earthquake had also suffered from the earlier one. The point of greatest violence was not, however, quite the same, for in 1783 it was placed by Sir William Hamilton near Oppido, about 26 miles south-south-west of Monteleone. The earthquake is best known in this country through the account of it contained in Sir Charles Lyell's 'Principles of Geology,' by it great landslips were caused, fissures opened in the earth, vents were formed from which sand and water spouted forth, and changes of surface-level produced. For a long time it was the standard instance, quoted in all text-books, of these greater manifestations of earthquake energy, and only within the last quarter of a century, principally within the last few years, have the older instances been superseded by later ones, studied in the light of a century's advance of knowledge. It does not seem, to judge from the reports which have reached this country, that the recent earthquake was by any means so great as that of 1783; this was distinctly felt at Naples, 200 miles from Oppido, and is said to have been noticed at Rome, a distance of 310 miles, the region of damage extended to 75, and that of destruction to 25, miles from Oppido. A comparison of these distances with those given in the case of the recent earthquake, will give some idea of the relative magnitudes of the two shocks, and in the matter of destruction of human life the disparity is even greater, for the 4000 deaths which have been due to the last earthquake are few beside the 40,000 at which Sir William Hamilton estimated the death-roll in 1783. Yet of this very earthquake, Sir Charles Lyell wrote that neither "in violence, nor in the extent of country moved, was this convulsion remarkable, when contrasted with many experienced in other countries, both during the last and present century; nor were the alterations which it occasioned in the relative level of hill and valley, land and sea, so great as those effected by some subterranean movements in South America." * The comparative magnitude of the earthquake is indicated by this sentence, and also shown by the fact that the amplitude of the record on Prof. Milne's seismograph at Shide was the same, viz. 11 millimetres, as in the case of the Indian earthquake of April 14 last, though the origin was four times further off in this case than in the other.

Iceland.—A Consular Report (Ann. Series, 3350) gives the population of Iceland, on December 31, 1904, at rather more than 79,000, and of Reykjavik at 8000. Seven hundred and fifty persons emigrated from Iceland in 1903 and 1904. In January, 1905, earthquakes, not destructive, were felt at Reykjavik and the south of Iceland. Imports and exports in 1901 and 1902 show an increase on preceding years. Next to Denmark, the United Kingdom enjoys much the largest share of the traffic. Salt fish is more than ever the most important article of export. Spinning and weaving factories having been recently established, the export of wool to Norway is reduced to insignificance. Barter is rapidly becoming obsolete. In June, 1904, a bank was opened, issuing notes payable on demand. The Great Northern Telegraph Company at Copenhagen was in the spring of this year to begin laying a cable from the Shetland islands to Iceland. The tonnage entering Icelandic ports in 1902 (which reached a total of 84,609) shows an increase, especially in steam shipping. A new lighthouse has been erected near Seydisfjord, which, with its good harbour and first-class accommodation for loading and unloading, has become a staple place for a great part of the island, and a coaling-station for liners and fishing-vessels.

ASIA.

Messrs. Barrett and Huntington in Central Asia.—Writing from Khotan on July 21 last, Prof. Ellsworth Huntington sent us some account of the progress of this expedition down to that date. Before leaving Leh, Mr. Huntington had made an excursion to the Pang-kong lake (14,000 feet), on the borders of Tibet, and he gives an interpretation of the lake's history which differs from that of former travellers. In his view it occupies a long narrow rock-basin, produced by the erosive action of the glacier—some 200 miles long—which once occupied the valley. Since the formation of the basin the level of the lake has fluctuated two or three times during later, less severe, glacial epochs. The route followed across the Himalaya was that by the Karakoram pass, a start being made a month before the usual opening of the road. The weather was fortunately good, and no serious difficulties were encountered, but the badness of the road exceeded all anticipations. In Chinese Turkestan, the authorities had proved helpful in every way, and some good scientific work was being done. The moraines and terraces in the mountain valleys confirmed the hypotheses formed further west. The travellers were able to observe the deposition of loess daily before their eyes. It was hoped to devote the autumn to the southern border of the Tarim basin, and the winter to Lop Nor, the idea of a visit to Tsaidam having been abandoned for the present.

* 'Principles of Geology,' chap. xxix., 11th ed., p. 113.

Mr. Hosie's Journey in Western China.—A report by Mr. Hosie on a journey undertaken by him last year from Chengtu to the Tibetan frontier has been issued as a Parliamentary Paper (China, No. 1, 1905). The outward journey was made over well-known routes; the first part, as far as Ta-chien-lu, following the southern road *viâ* Mount Omi and the valley of the Tatu-ho or Tung river, which has been described (among others) by Mr. Little in his book, "Mount Omi and Beyond." Mr. Hosie, however, supplies a wealth of details on the country traversed and its people, which make his report a useful supplement to previous accounts. Among the points to which he gives special attention are the trade and trade routes, industries and manner of life of the people, the extent and nature of cultivation, and other subjects. He also records frequently the altitudes along the route, though, as he merely refers to these as taken with the "hypsometer," it is not quite clear what amount of dependence is to be placed on them. The height of Mount Omi he found to be 10,158 feet, as compared with Baber's estimate of 11,100 feet. As regards the Tung valley, he expresses his astonishment that any trade can exist by such a route, and the fact that it does shows, he says, the spirit of enterprise which makes the Chinese the born trader that he is. As a trade route to Tibet, the northern route from Ta-chien-lu onwards * is said to be much more used than the better known official route *viâ* Batang, which he himself followed. It passes through the native state of Derge (noted for its copper work), west of the upper Yalung. While at Ta-chien-lu Mr. Hosie made careful inquiries as to the Tibetan trade, and he puts the quantity of the brick tea which goes west from that frontier post as 11,377,333 lbs. The principal import into Ta-chien-lu from Tibet is musk, while the import of wool seems to be less than has been supposed. A small amount of cotton cloth is received from Burma, through Yunnan. Between Litang and Batang brigandage seems to have driven trade from the official route, and it follows instead a small road *viâ* Mai-ya-ku. From Batang Mr. Hosie paid a visit to the Tibetan frontier, some excitement being thereby caused among the Tibetan authorities, who assembled the guard to oppose his further advance. The news of the British entry into Lhasa and the flight of the Dalai Lama reached the Chinese commissary who accompanied him the day after leaving Batang. Near Batang some attempt has lately been made by the Chinese to bring the waste land into cultivation, but elsewhere the extent of land under crops is exceedingly small. In the country of mountain and forest between Ta-chien-lu and the frontier, the limit of cultivation is under 13,000 feet. The trees mentioned most frequently are the prickly oak and the silver fir, the former apparently preferring the southern, the latter the northern slopes. The return from Ta-chien-lu to Chengtu was made by a more northerly route than the usual one, through a country that has been little visited by Europeans.† It led north across the Ta-pao-Shan (14,490 feet) to Romi Chango, in the valley of the Ta-chin-ho (Great Gold river), as the upper course of the Tung is here called. The road was bad and involved many difficulties, a considerable amount of snow having already fallen. Mr. Hosie came in contact with some of the aboriginal tribes inhabiting this region, who speak one language with slight variations. For writing it they employ the Tibetan characters (omitting the superfluous letters), but they do not understand Tibetan. From the valley of the little Gold river the route (here a trade highway) strikes across to Kuan Hsien on the Min above Chengtu.

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* This is the route traversed in its eastern section by A-K, and further west by MM. de Rhins and Grenard.

† It had been previously traversed by the Russian Potanin and the Austrian Rosthorn (cf. *Journal*, vol. 15, p. 277).

The Russo-Japanese Treaty.—By the treaty of peace signed at Portsmouth, N.H., on September 5, Japan once more receives an accession to the area of her territories. In the case of Korea she assumes a virtual protectorate, Article 2 of the treaty stating that Russia recognizes the preponderant interest, from political, military, and economic points of view, of Japan in the Empire of Korea. While Manchuria is to be evacuated by both powers, the Russian rights possessed through the lease of Port Arthur and Dalni, with adjacent territory, pass over entirely to Japan. Russia also cedes to Japan the southern part of Sakhalin island, as far north as the 50th degree of north latitude. The areas represented by these three territories are approximately as follows: Korea, 85,000 square miles; Port Arthur, etc., 1000 square miles; Southern Sakhalin, 12,000 square miles. With these additions the total territory possessed by or under the influence of Japan now amounts to about 260,000 square miles. In addition to the above, Japan takes over the Russian rights in respect of the southern section of the Manchurian railway, with the mines in its vicinity. The railway is to be worked by the two powers jointly, a junction between the two sections being effected at Kwang-cheng-tse, and through commercial traffic is to be encouraged, while the use of the line is restricted to commercial and industrial purposes.

Origin of the Name Celebes.—To the explanations lately suggested by various writers as to the origin of the name Celebes, another has been added in the fifth number of *Petermanns Mitteilungen* for the present year by Baron von Hoëvell, formerly governor of the island. He points out that the name is not in use among the inhabitants (who speak instead of Tanah Mangkasara, or Tanah Bugise), so that it must have been originated by foreign visitors. The explanation current in Macassar is that on the first arrival of Europeans the name of the island was asked for; but, as so often happens in similar cases, the tenour of the inquiry was misunderstood, it being thought that it related to the kris always carried in the girdle. The answer was, therefore, "Séle besi" ("an iron kris"). In accordance with this, it is stated that the current accentuation on the second syllable is of modern origin, the accent having been formerly placed on the first. Of previous explanations, that of Dr. F. Sarasin derived the name from the mountain range Kalabat, but it was pointed out in opposition to this that the *c* in Spanish and Portuguese is always soft before *e*.

AFRICA.

Mr. R. MacIver on the Rhodesian Ruins.—In view of the meeting of the British Association this year in South Africa, Mr. R. MacIver went out to Rhodesia in April last under the auspices of the Association and of the Rhodes trustees for the purpose of examining the ancient ruins of that country, the intention being that, on the visit of the Association to Bulawayo, the results of his investigations might be put before the meeting. This was done in a lecture delivered on September 9, in which Mr. MacIver surprised his audience by putting forward conclusions which, if accepted, must revolutionize *in toto* our ideas as to the history of the ruins. He has examined a number of the more important ruins, including those of Zimbabwe, Inyanga, Niekerk's farm, Dhlo-Dhlo, and Insiza, and has reached the conclusion that none of the ruins are older than the fifteenth or sixteenth century, but that they were the work of native Africans under the dynasty generally known as Monomotapa. From the brief summaries of the lecture which have yet reached this country by means of the telegraph, it is, of course, impossible to express any opinion as to the validity of the arguments by which this surprising conclusion has been reached. Many of the statements quoted in the reports of the lecture seem to be matters of opinion, and will need to be supported by conclusive evidence before they are likely to be accepted by archæologists. Such statements are that the buildings are essentially of a native type common to-day; that neither the buildings nor the other articles found show traces of early oriental influence; that the soapstone birds, etc., so often described, represent totems; and others of a similar character. Mr. MacIver believes that the ruins were originally fortified places, usually enclosing a kopje built in the form of a rough ellipse following generally the contour of the surrounding country. The "pit-dwellings" described by previous investigators are held to have originally been citadels round which concentric walls were built. Zimbabwe, as the residence of the sovereign, was more elaborately built than the rest, but its plan was essentially the same. Whatever may be Mr. MacIver's experience as an archæologist, it is difficult to believe that the character of the remains can have been so totally misunderstood by all previous observers, and, in any case, we may be sure that the last word has not been said on the subject.

The Zambezi Bridge.—The great bridge by which the railway is carried across the Zambezi just below the Victoria falls was formally opened by Prof. G. Darwin, President of the British Association, on September 12, with due ceremony. At a dinner which took place the same evening, the health of Sir C. Metcalfe, the eminent engineer under whose direction the great work has been carried out, was proposed by Prof. Darwin.

Irrigation in Cape Colony.—A report by the Director of Irrigation on works and localities in the north-west districts of Cape Colony, visited by him in June–July, 1904, contains some interesting geographical items. Between Britstown and Prieska, Tigerpoort Vlei, a flat of some 5000 acres of fertile alluvial soil and small surface slope, was found capable of being brought under flood-irrigation by means of a short canal taking off from the left bank of the Brak river, the cost of the construction of which would be amply repaid by the returns. As a river the Brak is of recent origin. Where the river now is, there was, some fifty to sixty years ago, a series of reed-bordered pools fed by the waters straggling over the intervening flats. The low-lying lands along this watercourse became in this way thoroughly saturated at every flood, covered with thick grass and bush, and even in years of drought afforded valuable grazing and plentiful supply of drinking-water. To-day the river channel has a mean width of 240 feet, and a depth of 15 feet, and it is only a very extraordinary flood, like that of September, 1901, which tops the banks of the river and spreads over the valley lands. Such floods are of short duration, and, with a deep channel affording a free outfall for the drainage, the soil and subsoil soon lose their moisture. One bad drought withers up the grass and seriously injures the bush. Yet, the slope of the country being sufficiently flat, there should be no great difficulty in restoring the lands to their original pastoral condition, or, where the soil is deep enough, in bringing a large portion of them under the plough. Since November, 1903, the Brak had been in flood at least five times. Early in November, and once again before Christmas, it ran 1½ foot deep for two or three days. In January it was impassable for three days, and continued in flow for nineteen or twenty days. Between January and March it came down twice, carrying a good supply for a week. A gauge has been erected in the river near Kaffir's Poort, and readings are to be taken while the river is in flow. From Prieska a descent was made of the Orange river to Upington. Six miles lower the river runs in a roomier valley 2 to 6 miles wide. Flowing with reduced velocity, it has deposited its silt and formed on each side of its present main stream a series of islands, extending 60 miles in length, intersected by innumerable sluits down which the water spills when the river rises in flood. Together with the alluvial tracts on the adjoining mainland, this land is roughly estimated to comprise 60,000 acres of exceedingly fertile irrigable land. Leaving the Orange river and ascending the Hartebeeste, crossed by a dam at Rooiberg, halt was made at Van Wyk's Vlei, where there is a dam collecting the drainage from a catchment of about 800 square miles. On the way thence to Brand Vlei, inspection was made of various "Saai dams"—low embankments thrown across a flat valley to pen in water and ensure a sufficiency of moisture for the germination and sustenance of a crop. A form of irrigation extensively used in India, it was here for the first time encountered in the country of the Cape. The remainder of the tour traversed the Zak, Fish, and Doorn rivers, terminating at Ceres.

AMERICA.

The Course of the Tennessee River.—After flowing south-west in an open longitudinal valley to a point near Chattanooga, the Tennessee river makes a sudden bend to the west, and flows for some distance through a winding gorge before again resuming its original direction in a second longitudinal valley. These features have been explained, by Dr. Welland Hayes, Mr. M. R. Campbell, and others, as due to a striking instance of river capture at the close of the Tertiary period, it being held that the Tennessee river formerly held on its south-west course past Chattanooga into the Coosa river, and so on to the Alabama, the diversion being due to the cutting back by one of the tributaries of the Sequatchie through the high flat-topped Walden ridge. These views, which have been very generally accepted by geologists, have lately been challenged—first by Mr. C. H. White, who developed his objections in the *Journal of Geology* (Chicago), vol. 12, pp. 34–39, and more recently by Mr. D. W. Johnson, who clearly sums up the arguments for and against the theory of capture in the same *Journal* for April–May of the present year (vol. 13, No. 3). Mr. Johnson, who has made a close study of the subject of river-capture in general, as well as the previous literature on the Tennessee river, has also personally examined the locality of the supposed capture. Among the arguments in favour of this, the principal are—the indistinct character of the divide now separating the Tennessee from the Coosa south of Chattanooga; the correspondence of the volume of material deposited by the Alabama during Tertiary times with that eroded by the upper Tennessee and Coosa; and the youthful character of the gorge. It is shown, however, that these facts are not inconsistent with the idea that there has been no change in the general course of the Tennessee since the close of the Cretaceous period, while it is held that many facts tell in favour of this idea and against that of capture. Thus the winding nature of the gorge seems to imply that the meanders were developed when the river flowed at a higher level over the Cretaceous peneplain now represented by the Walden ridge, while the difference in level between the Sequatchie and upper Tennessee valleys seems insufficient to have enabled a tributary of the former to cut back across the dividing ridge. On the whole, the balance of evidence certainly seems against the theory of capture in this case.

The Water-level of the Great Lakes.—In connection with the unusual level reached by the great lakes during the high water of 1904, Prof. A. J. Henry sketches, in the *Monthly Weather Review* for February, 1905 (Washington, April 25), the *régime* of the fluctuations of level in the lakes as deduced from the records of the past ten years. He shows that there is a regular annual fluctuation which brings the waters to a maximum in summer, followed by a decline to a minimum in winter or spring. There is also another series, superimposed in the first, which generally extends through several years, an upward tendency being maintained through several successive seasons. The annual rise begins with the breaking up of ice in the rivers and streams, and the maximum is generally reached in midsummer, the rise, however, being somewhat retarded in the case of Lake Superior as compared with the more southerly lakes. As soon as high water is reached the level begins to fall, at first slowly, but quite rapidly as winter approaches. The chief agents in both series of changes are naturally atmospheric influences—precipitation, temperature, and evaporation. The winter temperature is important, as evaporation is greatly increased in a warm winter. Thus Prof. Henry calculates that the difference in amount of evaporation may reach as much as 3·5 inches. Changes of level may also be due to alterations in the outlets, in the case of Huron and Erie, but in the case of Superior atmospheric conditions seem the ruling factor. An unusually low level was reached in all the lakes in 1895, the extreme range between this and 1904 being about 3 feet on Ontario. This low level, caused by persistent drought, coupled with periods of abnormally high temperature and greatly increased evaporation, made its influence felt for several years, the loss being only made good after a continuance of favourable conditions. Thus high water was not again reached on Lake Superior until 1899.

Indian Shell-mounds in Southern Brazil.—The shell-mounds which form so marked a feature on the Atlantic coast of Central and South America are described and illustrated by G. von Koenigswald in the issue of *Globus* for June 1, 1905 (vol. 87, No. 20). These mounds, known in Brazil by the Indian name "sambaqui" (= shell mountains), have been much drawn upon, both by the natives and by the Jesuits during the time of their ascendancy in this region, for the construction of modern buildings, and many have been almost entirely removed, though vast accumulations of mollusc-shells still remain. The position of the primitive settlements which they represent was carefully chosen on the shores of bays in which fish and molluscs abounded, being placed on small rising grounds screened from view, seawards, by the mangrove fringe along the swampy shore. Where the settlements were placed in low-lying tracts, the shell-heaps themselves formed the solid foundation on which the dwellings were placed. In these cases, which are by far the most numerous, the mound was flat and broad, whereas in places where a natural elevation existed for the location of the settlement, the form is more conical. The author of the paper has examined some 150 sambaquis between Rio and the borders of Uruguay, some of them reaching a height of 60 feet and over. The objects found in the mounds bear witness to the varying degree of culture possessed by the successive inhabitants, the stone implements associated with the lower layers being of the most primitive description, while at higher levels they are skilfully worked and polished. It is a remarkable fact that the ancient distribution of the tribes revealed by a study of the implements corresponds closely with that observed by the Portuguese on their first arrival.

New Administrative Division of Colombia.—The July number of *La Géographie* records some administrative changes lately introduced in Colombia. Four new departments have been created, viz. Galan (chief town San Gill), Caldas (Manizales), La Plata (La Plata), and l'Atlantico (Barranquilla). The city of Bogota has been dissociated from the province of Cundinamarca and made into a "district capital," but the chief town of the province has not yet been fixed.

AUSTRALASIA AND PACIFIC ISLANDS.

Pitcairn Island.—According to a Colonial Report (Misc. No. 30), the Pitcairn islanders number 77 males and 92 females. Among themselves they speak a patois the peculiarity of which is traceable back to the Tahitian women, who, with the mutineers of the *Bounty*, occupied the island in 1870. Yet most of the adults speak English fairly well. Converted some years ago into Seventh-day Adventists, the islanders scrupulously observe their sabbath day, and attend prayer meetings and pay tithes, but apparently without mending their too notorious deviations in the way of immorality, theft, and brawling—vices in their case not due to the use of intoxicants. The prevalent diseases are consumption, lupus, glandular swellings, asthma, and skin affections. It is noted that the front teeth are mostly bad. Since becoming Adventists they possess no pigs, but have been advised to start breeding them. Having neither copra (the island producing no coconuts) nor shell for disposal, and only a precarious rainfall, the people are poor. Coffee, however, of superior quality grows luxuriantly, and with pigs and coffee for export, direct communication might be established with Tahiti. At present there is but a poor cutter plying between this island and Mangareva. Pitcairn also grows excellent arrowroot, and, with proper machinery and appliances, might yield 250 tons per annum.

POLAR REGIONS.

The Voyage of the Duke of Orleans.—News received in Sweden early in September from Reykjavik, in Iceland, announced that a successful voyage to the east coast of Greenland had been made by the Duke of Orleans and his party on board the *Belgica* (*Journal*, July number, p. 90). The expedition had reached a higher latitude than is positively known to have been attained from the east on this side of Greenland, the farthest being in 78° 16′ N., or considerably to the north of Cape Bismarck, discovered by the German expedition under Koldewey in 1870. Cape Bismarck itself was found to be not on the mainland, but on an island, the Dove bay of the German expedition being thus in reality a strait. Since the time of that expedition this northern section of the East Greenland coast had been little visited, though Captain Naero is said to have reached 75° 30′ N., or just north of Shannon island, in a Norwegian whaler in 1900 (*Pet. Mitt.*, 1900, p. 220). It will be remembered that a point on this coast still further north was said to have been reached by the old whaler Lambert in 1670; while Daines Barrington also spoke of a high latitude having been reached on the same coast in the eighteenth century; but these reports must be considered as exceedingly doubtful. Some good oceanographical work is said to have been accomplished by the Duke of Orleans' party, which included some competent observers.

The Ziegler Arctic Expedition.—On landing at Hull, on his way home to America, Mr. Fiala communicated to Reuter's representative an outline of the chief events of his expedition, which makes it possible to add some details to the statement made in the September number of the *Journal*. After leaving Vardo on July 10, 1903, the *America* encountered great difficulties from the state of the ice before reaching Franz Josef Land, steaming east until close to Novaya Zemlya without finding an opening. Only on August 12 was it possible to make Cape Flora, Teplitz bay being reached by the end of the month, and a base camp established there. It was named Camp Abruzzi. After narrowly escaping destruction on October 22, the *America* was crushed by the ice on November 21. On January 22, 1904, a violent gale brought a further disaster, the ship finally disappearing, as well as a quantity of coal and provisions that had been cached on the ice. The high temperature which prevailed kept the sea open off the north-west coast of Rudolf island during almost the entire winter, and two sledge expeditions which started in March, the second of which made its way to the sea ice past Cape Fligely, had to return completely baffled. Leaving a small party of volunteers at Camp Abruzzi to renew the attempt the following year, Mr. Fiala went to Cape Flora to await the relief ship, but when all hope of succour had been given up, he returned to Camp Abruzzi to make preparation for another sledge expedition northwards in 1905. The journey occupied a month, and during the latter part of the way the rough channel ice had to be crossed in dense darkness. The weather in 1905 proved worse than in 1904, the abnormal warmth making the ice exceedingly dangerous. The new attempt proved equally a failure, but a party under Mr. Porter (third in command) did some exploring and mapping to the south. Scientific work was also continued without interruption at Camp Ziegler, whither the bulk of the expedition was transferred, and where the news of the arrival of the *Terra Nova* reached the leader on August 1. The explorers had been cut off from the rest of the world for two complete years.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Indian Ocean Expedition.—Prof. Sedgwick has communicated to *Nature* (August 10, 1905) a letter received by him from Mr. Stanley Gardiner, giving an account of the progress of the expedition in the *Sealark* for the scientific exploration of the Indian ocean down to about the end of May. Soundings taken during that month between the Maldive and Chagos groups had not confirmed the existence of a bank between the two groups, which the soundings of the *Valdivia* Expedition had indicated as possible. A depth of more than 2000 fathoms was obtained, and though this is small compared with the depths both to the east and west, Mr. Gardiner remarks that one obviously cannot build up any views of a possible former connection of the Maldive and Chagos banks on such a slender basis. During the passage, samples of the sea-water were taken, and of the pelagic organisms existing at varying depths. On May 19 the *Sealark* reached the Ile de Diamant, Peros Banhos atoll, but the exposure of this atoll to the force of the south-east trades then prevailing made it necessary to postpone a thorough examination of it. It was therefore decided to move to the Salomon atoll, nearly enclosed by a surface reef, and here a camp was formed on shore. While Mr. Gardiner and his colleague, Mr. Cooper, collected the marine flora and fauna and examined the reefs and land, Captain Somerville and the officers of the *Sealark* made a fresh large-scale chart of the atoll, and Mr. Fletcher and Dr. Simpson collected insects and land-plants. Mr. Gardiner was struck by the absence of life on the reefs, for though there are plenty of corals in places, the number of species is quite limited. He was endeavouring to obtain light on the physical conditions prevailing, so as to find an explanation of the paucity of free-living animals. The *Sealark* was about to proceed to Diego Garcia to coal, Mr. Cooper going in the ship to examine the land and reefs. The observations of the land-plants had brought out some interesting facts as regards their local distribution, definite zones with their own special plants being found on most of the islands.

Volcanic Action and the Permanence of Ocean Basins.—A collection of rocks recently brought to Cape Town from Tristan da Cunha serves Mr. E. H. L. Schwarz, of the Geological Survey of Cape Colony, as the text for a discussion of various controversial subjects connected with the physics of the Earth's crust. While most of the rocks collected are similar to those brought from the island by the *Challenger* Expedition, there is a novelty of some interest in the form of a block of gneiss picked up in the neighbourhood of the settlement at Edinburgh. That this rock was not brought to the island by some external agency seems confirmed, in Mr. Schwarz's view, by the occurrence, among rocks from Nightingale island, of fragments of a porphyritic rock embedded in the lavas. They are of minute size, and have evidently been derived from the shattering of a foreign igneous mass of an acid type by explosions, such as occur in the throats of volcanoes, and thus cannot have been drifted to the island. While allowing that the evidence is not as good as one could wish for, Mr. Schwarz thinks it reasonable to suppose that this granite belongs to the islands, and that it, with the gneiss above mentioned, is an indication that rocks of a continental type exist in them side by side with those of purely volcanic origin, which have been held to be typical, with few exceptions, of oceanic islands. This would be a somewhat slender foundation on which to build an argument against the permanence of ocean basins; but the writer founds his conclusions on other facts brought to light in many parts of the globe, which he summarizes as recorded in an extensive literature. Still, it must be confessed that his arguments do not greatly affect the position of the problem, which will continue to be warmly debated by the champions of the rival theories. Of the instances of oceanic islands containing continental types of rock, few are not more or less in association with one or other of the submarine continental plateaus. The most important exception is that of Ascension, to which, if Mr. Schwarz's assumption is correct, Tristan da Cunha may now be added. But on other grounds the probability of a former connection between the lands on opposite sides of the South Atlantic has long been granted, so that this may to some extent be considered outside the controversy. In any case, the existence of continental rocks in oceanic islands would merely show that the permanence of ocean basins is not to be regarded as absolute, which few even of the upholders of the theory would venture to do. It is far from justifying the idea of a perpetual see-saw between the oceans and continents. Mr. Schwarz's discussion of volcanic action generally rests on a somewhat broader basis, owing to his personal acquaintance with many of the old volcanoes of South Africa. He gives many instances of non-volcanic matter being brought up by volcanic eruptions, and of eruptions which can be shown to have been accompanied by no great amount of heat. The solid rocks brought up in volcanic pipes show, in his view, that the chimneys cannot have their origin in really profound depths, or tap a problematical molten magma, but he considers them due to the heat caused by the crushing of rocks along structural lines, which are thus the actual seat of the fusion, instead of merely supplying the vents for the molten matter. This revives the theory of Mr. Mallet, which he holds to have been rejected on insufficient grounds.

Influence of Height above Sea-level on the Light-absorption of Plants.—In the *Sitzungsberichte* for February, 1905, of the Imperial Academy of Sciences in Vienna (Mathemat. Naturwissens. Klasse), Prof. Julius Wiesner gives the results of his investigations into the light-appropriation of plants in the Yellowstone and other regions of North America. The author, who for six years has been prosecuting his studies on absorption of light by plants in its dependence on geographical conditions, has now, with the assistance of the Imperial Academy of Sciences, supplemented them by an investigation into the influence of height above sea-level on the mode and extent of such absorption. The studies on the influence of geographical latitude were extended to 6° S. and 79° N. lat., and the results have from time to time been made public (see note on "Light and Vegetation in the Arctic" in *Journal*, June, 1901, p. 665). For the later, as for the earlier, investigations a suitable locality was not found in Europe. Vegetation ceases at relatively too low heights above sea-level, as in the Alps, or, as in the Southern European mountain chains, there are too few high plains suitable for observation. Only the Rila mountain chain in South Bulgaria would, in the opinion of Prof. L. Adamović, of Belgrade, constitute an exception in this respect. The high regions in the Yellowstone territory of the United States were found, however, to offer far better opportunities, and observations were here made along a section of country 560 miles in length, with a difference of level amounting to 8200 feet. It extended from Bismarck on the Missouri, in North Dakota, to the north-west end of the National Park. The main results of the investigations are as follows: With a rise in height above the sea-level, not only is the intensity of the total daylight increased, but also the intensity of the direct sunlight as compared with diffused light. Whereas the further the plants of the Arctic Regions press towards the pole the more of the total light do they strive to obtain, the plants ascending upwards act correspondingly only up to a certain height. Above this, on the contrary, they avail themselves of the proffered light to a progressively less extent. This is indicated in the cypress-shaped form of conifers, such as the *Pinus Murrayana*, the commonest tree of the Yellowstone Park. In the case of the cypress proper, this form wards off the most intense rays of the vertical sun of the south, while in that of these high mountain pines it wards off the rays of which the intensity is due to the height above sea-level. The injurious effect of the vertical radiation is shown by the fact that plants which in lower situations, under otherwise like conditions, preserve their leaves, are at these heights subject to the fall of the leaf. The Arctic limit for the life of a plant will occur where maximum and minimum of light-absorption coincide, as, according to Prof. Wiesner's own observations, for Betula nana, in Spitzbergen. An altitudinal limit determined by light for the growth of a plant is not, however, to be established, seeing these relations are much more complicated than those having reference to Arctic limit. In the case of the latter, the question concerned only a vegetation continuing at a uniform level—close to that of the sea. The influence of elevation, on the other hand, is confused by the change of latitude, seeing that with decreasing latitude vegetation mounts to ever greater heights, the direct radiation to which it is exposed increasing in proportion. Some observations instituted at great heights (as high as 13,400 feet), on Pike's peak, closely suggest the question whether the plants which mount to great altitudes above sea-level do not reduce their maximum of light-absorption, so that the maximum and minimum of the requirement of light approach each other or possibly coincide. This would avail as a further defence against strong light. A solution of this question could be obtained only at a great height above sea-level in very low latitudes.

GENERAL.

The London School of Economics.—We have received the 'Calendar' of this institution for 1905–6, covering the eleventh session since its foundation, and giving, besides a short account of its aims and methods, a full list of the courses of lectures and other forms of instruction for the academical year now opening. The school, which is virtually the only institution at which a commercial education of the highest grade can be obtained in this country, is carrying on a most valuable work, and even though its aims are more strictly utilitarian than some other educational agencies, the exceptionally strong staff of lecturers whose services are at its disposal is a guarantee that the subjects will be studied in a way that will bring out their full educational value. Under its present director, Mr. Mackinder, the claims of geography to the attention of those contemplating a career connected in some way with commerce or economics are thoroughly safe, and the list of lectures, etc., provided under this head is an encouraging evidence that some headway is being made in the improvement of geographical teaching in this country. Although special prominence is, of course, given to the commercial bearings of the subject, the whole teaching is, as it always should be, based on physical geography, and the courses will thus supply an excellent general training to teachers and others who may join the school without proceeding to one of the degrees of the University of London. Besides the 'Calendar,' a pamphlet is issued specifying the courses of special interest to students of geography, and this may be obtained on application to the Director of the School, Clare Market, W.C.

The Oxford School of Geography.—The syllabus of arrangements for the term now beginning shows that under the new Reader, Dr. Herbertson (who was appointed to the post vacated by Mr. Mackinder early in the summer), the work of the Oxford School of Geography will be carried on with undiminished energy. From his previous important services to the school as Lecturer in Physical Geography, Dr. Herbertson is better qualified than any one to carry on the work of his predecessor, and the continuity of aim and method thus secured will be a great advantage. The list of proposed lectures and classes shows that a thorough grounding in the principles of geography will be given to the students who attend, and the close personal supervision exercised by the Reader, and the due provision for practical work and informal discussions of points of current interest, augur well for the future of the school. In addition to the reader's lectures and classes, courses of personal instruction will be given by Dr. Grundy, Mr. Beazley, Mr. J. L. Myres, and the newly appointed instructor in surveying, Mr. N. F. Mackenzie. The term's work will open on October 16, when the Reader will see intending students at the Old Ashmolean building from 11 a.m. to 1 p.m.

Death of Tippu Tip.—The famous Arab trader, with whom so many of the great African explorers from the time of Cameron and Stanley onwards were brought into relation, died at Zanzibar on July 14 last. The part played by this bold adventurer in Stanley's great journey down the Lualaba-Congo will be remembered by all readers of 'Through the Dark Continent.' Most travellers have borne witness to the courtesy and straightforward character of the Arab trader, who was of a distinctly higher type than the majority of the adventurers by whom Central Africa was overrun during the latter half of the nineteenth century. Sketches of his life and character, with portraits, are given in the *Mouvement Géographique* for June 18 last, and in the *Deutsches Kolonialzeitung* of July 15. Tippu Tip's grandfather hailed from Maskat, and both he and his son Mohamed bin Juma took prominent parts in the establishment of Arab influence in East Africa in the middle of last century.

Elisée Reclus—Obituary. Erratum.—Page 342, for *facsimiles* read *fascicules*.

OBITUARY.

Captain Joseph Wiggins.

It is with much regret that we have to record the death of Captain Joseph Wiggins, at Harrogate, on September 13. Captain Wiggins acquired a wide reputation during the last quarter of the nineteenth century by his enterprise in opening up communication with North-Western Siberia by way of the Kara sea. It was on his skill as a navigator that Captain Wiggins's fame rested. Born in 1832, the son of a Norwich coach proprietor who died some ten years later, the boy had early to seek his living, and entered the mercantile marine when thirteen years of age. He rapidly rose in his profession, and gained his master's certificate, and, after experience in various parts of the world in command of sailing vessels and steamers, was in 1869 appointed Board of Trade examiner in seamanship for the ports of South Shields and Sunderland. Two years later, in 1871, Captain Wiggins became a Fellow of the Royal Geographical Society. Among other seas in which he had sailed was the Baltic, and he took a keen interest in the development of the vast resources of the Russian Empire. In particular, the question of establishing improved communications with the interior of Siberia greatly exercised his mind, and he conceived the idea of avoiding the long overland journey by a voyage through the Kara sea and up the great gulfs and rivers that penetrate to the heart of Asiatic Russia. The route was then entirely unfollowed, but its claims were beginning to attract attention, and in the early seventies a Russian merchant offered a reward to any one who would open up trading relations by sea between Europe and the Obi river. Captain Wiggins seized the opportunity of putting his long-cherished schemes to the test, and resigned his official appointment. Voyages undertaken in 1874 and 1875 at his own expense were unsuccessful, in so far as that he was not able to ascend either the Obi or the Yenisei; but they resulted in the acquisition of much useful information about the navigation of the Kara sea, and paved the way to success. A third voyage, undertaken with financial assistance in 1876, on board the *Thames*, a vessel of 120 tons register, did not end until Yeniseisk was reached, 900 miles as the crow flies inland from the head of the Gulf of Yenisei. During the next twenty years various other voyages by Captain Wiggins to the rivers Obi and Yenisei confirmed his theory as to the practicability of the Kara sea route to Siberia. Once, in 1894, he lost his vessel in the Kara sea; but the loss was not due to ice, but to fog and to an unexpected current. The opening-up of the route, however, excited strong opposition among those interested in the overland trade, and practically nothing has been done to follow up Captain Wiggins's enterprise. None the less, his skill and courage received widespread recognition both in Russia and in this country. He lectured before the Imperial Russian Geographical Society at St. Petersburg, and was presented by the Emperor Alexander III. with a service of silver plate. King Edward (then Prince of Wales) manifested great interest in the voyages, and received the navigator at Sandringham; while in 1894 Captain Wiggins was awarded the Murchison Grant by the Council of the Royal Geographical Society.

CORRESPONDENCE.

Marco Polo's Travels.

I. Did Marco Polo visit Baghdad?

In connection with the third edition of Yule's 'Marco Polo,' which has been recently edited by the well-known French geographer, M. Henri Cordier, it seems desirable to discuss some points which I have raised in my 'Ten Thousand Miles in Persia,' chap. xxiii., which chapter the French savant has referred to in various portions of the new edition. Chief among these questions is whether Ser Marco visited Baghdad. Not only is this important from the geographical point of view, but the question is one which, to a considerable extent, affects the veracity, or at any rate the accuracy, of the illustrious Venetian to no small extent. Consequently, it is a question which, in my humble opinion, should be settled without, if possible, leaving any doubt on the subject, and this I trust to be able to succeed in accomplishing.

Sir Henry Yule, in his introduction (vol. 1, p. 19), traces out the following itinerary for the travellers, viz. Ayas, on the Gulf of Scanderoon, and thence to Sivas and Mosul, from which point the Tigris was followed to Baghdad. From Baghdad the travellers, according to Yule, descended the Tigris and the Persian gulf to Hormuz.

This view I was, and am, unable to accept for the following reasons: Firstly, is it not unlikely that Marco should term the Volga the Tigris?* Secondly, in

* *Vide* vol. 1, p. 5 (2nd and 3rd editions).

describing the Caspian sea, the statement is made that "into it flows the great river Euphrates." *

Now, we know that Marco Polo never crossed the Volga nor saw the Caspian sea, and I hold that these colossal errors in geography are impossible, if we suppose that he travelled down the Tigris for many hundreds of miles, past its junction with the Euphrates. Any other view would surely lower the great traveller's reputation.

Let us, in the next place, examine the references he makes to Baghdad, or Baudas. Here he merely mentions that "Baudas is a great city, which used to be the seat of the Calif of all the Saracens in the world, just as Rome is the seat of the Pope of all the Christians." † The manufactures of Baghdad are indeed given, but no mention is made of the buildings, and, generally speaking, the whole description is meagre compared with his account of far less important cities, such as Yezd and Kerman. There is indeed a reference to the capture of the city by Alaü, or Hulaku Khan, but this, I would urge, by no means adds probability to Yule's views, as the echo of that grim tragedy must have resounded throughout all Asia and Eastern Europe.

Another point, albeit a minor one, is that, had Baghdad been the objective, would the travellers have taken so circuitous a route *viâ* Sivas, whereas, if we suppose them to be making for Tabriz, which was already beginning to attract through traffic at the expense of Baghdad, this route is more or less a natural one?

The above arguments are, however, but minor, if we consider the utterly inaccurate description of his supposed onward journey. To quote the text: "A very great river flows through the city, and by this you can descend to the Sea of India. There is a great traffic of merchants with their goods this way; they descend some eighteen days from Baudas, and then come to a certain city called Kisi, where they enter the Sea of India. There is also on the river, as you go from Baudas to Kisi, a great city called Bastra, surrounded by woods in which grow the best dates in the world." ‡

Now, in both these paragraphs there is separate and independent mention and inference that Kisi is at the mouth of the Sea of India or the Persian gulf, whereas it is situated some 400 miles from the mouth of the Shatt-al-Arab, which is the name given to the united streams of the Tigris and Euphrates.

Would Marco Polo have been guilty of such an astounding statement? Having studied his works carefully in parts where I can check it, I unhesitatingly answer in the negative.

This view is, I would urge, supported by a second reference to Kis, in which, on his return journey from China to Europe, he describes its position as regards the city of Calatu. The reference runs: "First, however, there is a point that I have omitted; to wit, that when you leave the city of Calatu and go between west and north-west a distance of 500 miles, you come to the city of Kis." §

Is it, I would ask, likely that Ser Marco would give this description of the position of Kis, or Kisi, if he had already touched at it on the way to Hormuz, his previous reference to which he mentions? One further point is that, if we accept Sir Henry Yule's views, the description of the route from Yezd to Kerman and thence to Hormuz must have been written in the reverse way to that in which Marco travelled, and this is surely out of the question, and by itself furnishes almost sufficient proof of the correctness of my views.

* Vol. 1, p. 52.
† *Ibid.*, p. 63.
‡ *Ibid.*, chap. vi. p. 63.
§ Vol. 2, p. 452.

It remains to add that Sir Henry Yule, in his note on the subject, wrote, "Polo is here either speaking without personal knowledge or is so brief as to . . . ;" and again, "I am inclined, however, to think that this was from not having visited it, *sc.* Kisi." In the plate entitled "Probable view of Marco Polo's own Geography," * the itinerary is not shown as running to Baghdad. M. Cordier, however, in referring to this important subject, quotes from my work, but in my opinion hardly meets my points in his note, which runs as follows: † —

"Major Sykes, in his remarkable book on Persia, chap. xxiii. pp. 262, 263, does not share Sir Henry Yule's opinion regarding this itinerary, and he writes: 'To return to our travellers, who started on their second great journey in 1271, Sir Henry Yule, in his introduction, makes them travel *viâ* Sivres to Mosul and Baghdád, and thence by sea to Hormuz, and this is the itinerary shown on his sketch-map. This view I am unwilling to accept for more than one reason. In the first place, if, with Colonel Yule, we suppose that Ser Marco visited Baghdád, is it not unlikely that he should term the river Volga the Tigris, and yet leave the river of Baghdád nameless? It may be urged that Marco believed the legend of the reappearance of the Volga in Kurdistan, but yet, if the text be read with care, and the character of the traveller be taken into account, this error is scarcely explicable in any other way than that he was never there.

"'Again, he gives no description of the striking buildings of Baudas, as he terms it, but this is nothing to the inaccuracy of his supposed onward journey. To quote the text, "A very great river flows through the city, . . . and merchants descend some eighteen days from Baudas, and then come to a certain city called Kisi, where they enter the Sea of India."

"'Surely Marco, had he travelled down the Persian gulf, would never have given this description of the route, which is so untrue as to point to the conclusion that it was vague information given by some merchant whom he met in the course of his wanderings.

"'Finally, apart from the fact that Baghdád, since its fall, was rather off the main caravan route, Marco so evidently travels east from Yezd and thence south to Hormuz, that, unless his journey be described backwards, which is highly improbable, it is only possible to arrive at one conclusion, namely, that the Venetians entered Persia near Tabriz and travelled to Sultania, Kashan, and Yezd. Thence they proceeded to Kermán and Hormuz, where, probably fearing the sea voyage, owing to the manifest unseaworthiness of the ships, which he describes as "wretched affairs," the Khorasan route was finally adopted. Hormuz, in this case, was not visited again until the return from China, when it seems probable that the same route was retraced to Tabriz, where their charge, the Lady Kokachin, "moult bele dame et avenant," was married to Ghazan Khan, the son of her *fiancé* Arghun. It remains to add that Sir Henry Yule may have finally accepted this view in part, as in the plate showing "Probable View of Marco Polo's own Geography," the itinerary is not shown as running to Baghdád.'

"I may be allowed to answer that when Marco Polo *started* for the East, Baghdad was not rather off the main route. The fall of Baghdad was not immediately followed by its decay, and we have proof of its prosperity at the beginning of the fourteenth century.

"Tauris had not yet the importance it had reached when the Polos visited it on their *return* journey. We have the will of the Venetian Pietro Viglione dated from Tauris, December 10, 1264 (*Archiv. Veneto.*, 26, 161–165), which shows that he was but a pioneer. It was only under Arghún Khan (1284–91) that Tauris became the great market for foreign, especially Genoese, merchants, as Marco Polo remarks on his return journey; with Ghazan and the new city built by that prince, Tauris reached a very high degree of prosperity, and was then really the chief emporium on the route from Europe to Persia and the far East.

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* Vol. 1, p. 107. † P. xix. of Introduction to vol. 1.

"Sir Henry Yule had not changed his views, and if in the plate showing 'Probable View of Marco Polo's own Geography,' the itinerary is not shown as running to Baghdad, it is mere neglect on the part of the draughtsman."—[H. C.]

It is to be noticed that in the above note M. Cordier hangs his reply mainly on the fact that Baghdad was more and Tabriz less important at that particular period than I had imagined. Here I am ready to bow to superior knowledge, albeit the fact is not fully proved; but the main points of my argument remain, in my opinion, unanswered, and, with all respect to M. Cordier, I think that this matter should be fully discussed, and not dismissed by a reference to the supposed neglect of a draughtsman. Personally, I consider Marco Polo to have been a shrewd observer and incapable of confusing the Tigris with the Volga, and of making the Euphrates—this is really a second confusion with the Volga—discharge into the Caspian sea, except on the supposition that he was writing on hearsay. Consequently I hold it that he passed by a route where he could not make personal inquiries into these questions, and this route would be the one selected by me.

To conclude, I maintain that Marco Polo entered Persia near Tabriz, whence he travelled to Sultania, Kashan, Yezd, Kerman, and Hormuz. From that port, owing to the unseaworthiness of the vessels, the presence of pirates, the fact that the season was past, or for some other reason, he returned by a westerly route to Kerman, and thence crossed the Lut to Khorasán.

Did Marco Polo visit the Tabas?

A section of Ser Marco's journey on which I have gained some recent information is that portion which lies between Kermán and the north. As far as Cobinan, still known as Kubanán, there is no doubt as to the identity of the place, even if the route adopted is not absolutely certain. Consequently we have now to deal with the onward section to Tunocain. Before proceeding farther, I will quote the text which runs, "When you depart from this city of Cobinan, you find yourself again in a desert of surpassing aridity, which lasts for some eight days; here are neither fruits nor trees to be seen, and what water there is is bitter and bad, so that you have to carry both food and water. The cattle must needs drink the bad water, will they nill they, because of their great thirst. At the end of those eight days you arrive at a province which is called Tonocain."* I was under the impression that a route ran direct from Kubunán to Tabas, but when visiting this latter town a few months ago I made careful inquiries on the subject, which elicited the fact that this was not the case, and that the route invariably followed by Kubunán-Tabas caravans joined the Kermán-Rávar-Naiband route at Cháh Kuru, 12 miles south of Darbana. It follows this track as far as Naiband, whence the route to Tabas branches off; but the main caravan route runs *viâ* Zenagan and Duhuk to Tun. This new information, I would urge, makes it almost certain that Ser Marco travelled to Tun, as Tabas falls to the west of the main route. Another point is that the district of Tabas only grows four months' supplies, and is, in consequence, generally avoided by caravans owing to its dearness.

In 1893 I travelled from Tun to the south across the Lut as far as Chah Kuru by this very route, and can testify to the general accuracy of Ser Marco's description,† although there are now villages at various points on the way. Finally as our traveller especially mentions Tonocain, or Tun va Kain, one is inclined to

* Yule's 'Marco Polo,' 3rd edit., vol. 1, p. 127.

† The eight stages would be—(1) Hasanábad, 21 miles; (2) Darband, 28 miles; (3) Chehel Pái, 23 miles; (4) Naiband, 39 miles; (5) Zenagán, 47 miles; (6) Duhuk 25 miles; (7) Chah Khushláb, 36 miles; and (8) Tun, 23 miles.

accept this as evidence of first-rate importance, especially as it is now corroborated by the information I gained at Tabas. The whole question, once again, furnishes an example of how very difficult it is to make satisfactory inquiries, except on the spot.

P. Molesworth Sykes, Major,
H.B.M.'s Consulate-General, Meshed.

June 29, 1905.

The Masai Uplands.

Nandi, British East Africa, May 14, 1905.

In reference to the sketch-map of Mr. C. W. Hobley, published in the *Journal* of March, 1905, I should like to make the following remarks:—

I made a trip in October, 1903, from the Government station at Nyeri (about 30 miles south-west of Mount Kenya), and marched in a northerly direction, crossing all the rivers forming the eastern watershed of the Aberdare range as far as the Pesi swamp. Thence I crossed the "Markham downs" to El Bor Lossat, and returned to Nyeri from there.

I made a plane-table sketch of the country I traversed, showing every stream I crossed, and it is interesting as filling up a gap between Mr. Tate's journey and that of Mr. Hobley.

The outline of the Pesi swamp I was unable to define accurately, as the whole place was a mass of papyrus, with the ground baked hard by the sun, and with the Pesi river cutting its way through in a deep channel. There can be no doubt that at certain seasons of the year the swamp is a large tract of inundated cotton soil, but owing to the dry season of the year at which I visited it I was able to traverse the whole of it dry-shod! The outline in my map is the extent of the papyrus, and I think coincides with the area of the swamp when inundated to its full extent. I could find no trace of open water. As regards the El Bor Lossat lake, which is a Masai name meaning "the deep swamp," I did not notice the neck of land separating the two lakes which Mr. Hobley marks in his map, and I could not have crossed it anywhere to my knowledge without wading through at least 3 feet of water. The circumference of the lake, marked by a continuous line in my map, is a well-defined bank about 18 inches above the water, which at the narrower end was covered with reeds and long grass, with numerous elephant tracks leading across. Wildfowl of all sorts were numerous. Mosquitoes were a perfect torment.

I notice Mr. Hobley does not mark Mount Korai, which is the high saddle-back hill forming the summit of Satima, the latter being the name of the northernmost block of the Aberdare range.

Nearly all the natural features in this district have both Masai, Dorobo, and Kilungu names; consequently different maps of the same district are extremely confusing, as showing totally different names for the same feature. Swahilis, on the other hand, if asked the name of features (say a river), will give it a name offhand, such as the Hippopotamus river (Nito ya Kiboko), or the Muddy river (Nito ya Topi).

I was travelling on my trip with Masai who had been bred and born on Laikipia, and, consequently, all the names of that district in my map are Masai

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* Map, p. 480.

names. The watershed of the Aberdare range from Mount Korai to Nandarua (Kinankop), and thence south to the Ingong hills, is of considerable interest.

The Morendat river is, I think, the only stream of any size that emanates from the Aberdare range flowing in a westerly direction, and this finds its way into Lake Naivasha in the Rift valley. All the other streams which rise in the Aberdare range find their way, some into the Guaso Nyiro, and thence into the Lorian swamp, and others into the Tana river, and thence to the east coast. It is noteworthy that those streams rising on the west of the Aberdare range turn north and south on reaching the foot of the hills, and, after taking a turn, skirt the extremities of the range and flow east. All the streams that feed the El Bor Lossat rise on the west of the range, and the overflow of this lake flows north and then east, eventually finding its way into the Guaso Nyiro. The rivers Chania and Thika, rising on the west of Nandarua, find their way down the hills in a westerly direction, but as soon as they reach the foot of the hills they turn abruptly south and then east, converging and eventually combining, and joining the Tana river between Donyo Sabuk and the Ithanga hills.

Thus the watershed may roughly be said to be a line drawn from Mount Kibibieri (Gojito of Thomson) in a north-westerly direction, and a line drawn from the same hill in a south-westerly direction, and not the Aberdare range as might be expected.

Further south numerous small streams, such as the Ruiru, rising in the Kitungu hills, flow into the Athi river, which itself rises in the Ingong hills. The Athi river, after entering the plains, flows in a northerly direction, takes a bend round the north of Donyo Sabuk, and goes as near as 2½ miles of the river Thika. It is curious that these two rivers (Athi and Thika), which are amongst the largest of the East Africa Protectorate, should come so close, and their junction or non-junction must have been a mere chance in the open plains, where they now flow, separated only by a strip of grassy flat.

The habit of rivers rising on the western face of a hill and eventually flowing east is further illustrated by the Tana river, which, rising on the west of Mount Kenya, flows south, and, after a large bend to the south, flows east towards the coast, being joined on its way by *all* the streams rising in the Aberdare range south of the Guaso Nyiro, the latter being joined by *all* * the streams rising in the Aberdare range north of itself. South of the rivers Chania † and Thika all streams flow into the Athi river as far as the Ingong hills.

My map illustrates most of the above remarks, including as it does all streams flowing east between Nairobi and the Pesi swamp, and should you deem it of sufficient interest to publish I should feel greatly honoured.

R. Meinertzhazen,
Captain Royal Fusiliers.

P.S.—It might interest you to know that during a recent journey I made from Nandi fort to the Ravine station across the Mau, I was able to see from one point Mounts Kenya and Elgon. Unfortunately, I only had a prismatic compass with me. The summit of Mount Kenya bore 103½°, and the eastern cone of Mount Elgon 325¾°. I must have been nearly 150 miles from Kenya and 80 from Elgon, the two hills being nearly 220 miles apart. My height was over 8800 feet.

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* A small insignificant burn, flowing south of and parallel to the Guaso Nyiro, joins that river. All streams south of this join the Tana river.

† I show two Chania rivers in my map, one flowing into the Tana past Nyeri hill, and the other rising in Nandarua and flowing into the Thika. The above-mentioned one is of course the latter.

Reclus' 'Universal Geography.'

"Aram-Gah," 79, Broadhurst Gardens, South Hampstead, N.W.,
September 5, 1905.

MAY I venture to call your attention to a few little inaccuracies in your obituary notice of Elisée Reclus in this month's *Geographical Journal?* In the distribution of the nineteen volumes of the 'Universal Geography,' you assign *five* to Asia and *four* to America. But if you look again you will see that these figures should be reversed—four to Asia and five to America. In speaking of the author's style, you remark that "naturally much is lost even in the best translation," leaving it to be inferred that there are more than one. But that is not so. There is only one—the first four volumes by Mr. Ravenstein, all the rest by me. Nor did M. Reclus think that "much is lost" in my version, for he wrote: "Clarens, le 29 Janvier, 1882. J'ai lu attentivement une partie de la traduction que M. Keane a bien voulu faire de ma 'Nouvelle Géographie Universelle,' et je suis heureux de lui témoigner ma reconnaissance pour le scrupul qu'il a mis à suivre le texte et pour l'élégance avec laquelle il l'a rendu. J'apprécie aussi pleinement l'avantage d'avoir trouvé en lui un traducteur qui puisse, grâce à sa parfaite connaissance de la matière, corriger ou compléter, en maintes passages, l'original français à l'aide de documents nouveaux.—ELISÉE RECLUS."

A. H. KEANE.

Northern Newfoundland.

I HAVE read with much interest Mr. Thomson's "Notes on a Journey through the Northern Peninsula of Newfoundland," having myself travelled on more than one occasion in the interior of the island. With regard to several points in these Notes, I venture to make a few remarks. Mr. Thompson mentions that he saw no deer whatsoever. This may, perhaps, be explained by the fact that, being summer, they had probably, according to their custom, begun to migrate southwards. I may add that, though in the warm weather I met with many does and calves, especially near Red Indian lake, I rarely saw any stags, as they keep to the woods to avoid the flies.

In 1898, I saw two bears on Exploits river, and on Gambo river, some two years earlier, I saw a beaver's dam, which was certainly occupied. A native who accompanied me had been attacked by a lynx in the same neighbourhood, and also told me that on one occasion he had met with wolves. I only saw one hare, which we killed and ate, but it was not very appetizing.

As to birds, I saw plenty of twillicks, jays, loons, and willow-grouse, and occasionally geese and ducks. The jays used to visit me during meals, and would eat what I threw to them quite close to me; they are known either locally or in Canada by the name of camp-birds. Owls were not wanting; I sometimes wished that they were!

Mr. Thompson makes no mention of flies, mosquitoes, and other biting insects. In the Gambo district I got much bitten by black fly, or some such insect, while in the Exploits country mosquitoes were most troublesome, except on the river-bank, where I never saw one. Whenever I killed deer, bluebottles abounded, and with them came a fly somewhat resembling a wasp.

The chief results of my journeys in this country were the discovery of the last remains of the Beothiks' camping-grounds on the shores of Red Indian lake; and that the Victoria river, described on the map of Newfoundland as a river with only one fall and then smooth water, contained about six falls within a few miles.

I cannot say that I found it an easy country to travel in—at all events in the parts I visited, but very much the reverse. G. D. McGRIGOR.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Is. = Isvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Structure. *C. Rd.* **140** (1905): 1364–1367. **Lugeon and Argand.**
Sur les grandes nappes de recouvrement de la zone du Piémont. Note de M. Lugeon et É. Argand.

Austria. *Jahrb. Ungar. Karpathen-V.* **32** (1905): 66–75. **Hajnóci.**
Die natürlichen Verhältnisse und der Grubenbau des Zipser Erzgebirges. Von Dr. J. R. Hajnóci. [II.]

Austria. *Deutsch. Rundschau G.* **27** (1905): 346–358. **Lenz.**
Die Insel Brioni bei Pola als Beispiel einer modernen Kulturarbeit. Von P. Lenz. *With Map and Illustrations.*

Austria—Bosnia. **Vogel.**
XX.-XXIII. Jahresb. (1901–4) *Württemberg. V. Handelsg.* (1905): 3–26.
Durch bosnischen Urwald und bosnisches Kulturland. Von Prof. C. Vogel.

Austria—Geology. *M.K.K.G. Ges. Wien* **48** (1905): 196–219. **Hassinger.**
Zur Frage der alten Flussterrassen bei Wien. Von D. Hugo Hassinger.

Austria—Istria. *M.K.K.G. Ges. Wien* **48** (1905): 145–154. **Schneider.**
Ueber die Küstenformen der Halbinsel Istrien. Von K. Schneider. *With Sketch-maps.*

Austria—Population. **Brants.**
B. Classe des Lettres, etc., A. R. de Belgique (1905): 376–381.
Le groupement industriel et les premiers résultats du recensement en Autriche. Par V. Brants.

Baltic. *Geol. Mag.* Decade V., **2** (1905): 311–320. **Howorth.**
The Recent Geological History of the Baltic. Part i. The Litorina Sea. By Sir H. H. Howorth.

Belgium. *C. Rd.* **140** (1905): 1661–1662. **Martel.**
Sur la formation de la grotte de Rochefort (Belgique) et sur la théorie des effondrements. Note de E. A. Martel.

Belgium. *Mouvement G.* **22** (1905): 259–264. **Wauters.**
Le port de Bruxelles et le canal maritime au Rupel. Par A. J. Wauters. *With Map.*

Greece—Ithaca. **Salvator.**

Wintertage auf Ithaka. [By the Archduke Ludwig Salvator.] Prag: H. Merry Sohn, 1905. Size 15 × 11½, pp. 316. *Plates and Sketches. Presented by the Author.*

Brought out in the same sumptuous style as the Archduke's former publications.

United Kingdom—Coal. **Hull.**

The Coal-fields of Great Britain: their History, Structure, and Resources. With descriptions of the Coal-fields of our Indian and Colonial Empire, and of other parts of the World. By Edward Hull, LL.D., etc. Fifth Edition. Embodying the Reports of the Royal Coal-Commission of 1904. London: H. Rees, 1905. Size 9 × 6, pp. xxii. and 472. *Maps and Illustrations. Presented by the Publishers.*

The preceding edition having for some time been out of print, this will be welcomed as supplying a concise view of the coal question in the light of existing knowledge. The results of the inquiries by the recent commission have been embodied so far as they relate to the subject-matter of the work itself.

United Kingdom—Cotteswold. *Geolog. Mag.* **2** (1905): 216–219. **Callaway.**

The Occurrence of Glacial Clay on the Cotteswold Plateau. By Dr. C. Callaway.

United Kingdom—Coast-erosion. **Carey.**

Minutes of P.I. Civil Engineers **159** (1905): 42–57.

Coast-erosion. By A. E. Carey. *With Maps.*

United Kingdom—Coast-erosion. **Matthews.**

Minutes of P.I. Civil Engineers **159** (1905): 58–142.

Erosion on the Holderness Coast of Yorkshire. By E. R. Matthews. *With Maps and Plans.*

United Kingdom—Forestry. *J.S. Arts* **53** (1905): 529–542. **Maxwell.**

British Woodlands. By the Right Hon. Sir H. Maxwell, Bart., M.P. *With Illustrations.*

Urges the need for reform in British forestry.

United Kingdom—Geology. *B. Assoc. Rep.* (1904): 242–266. ———

Photographs of Geological Interest in the United Kingdom. Fifteenth Report of the Committee.

United Kingdom—Mersey. *B. Assoc. Rep.* (1904): 318–321. ———

The Tidal Régime of the Mersey. Report of the Committee.

United Kingdom—Minerals. **Rudler.**

A Handbook to a Collection of the Minerals of the British Islands, mostly selected from the Ludlam Collection, in the Museum of Practical Geology, Jermyn Street, London, S.W. By F. W. Rudler. London: E. Stanford, 1905. Size 10 × 6, pp. x. and 242. *Price* 1*s*. *Presented.*

United Kingdom—Rainfall. *Symons's Meteorolog. Mag.* **40** (1905): 21–25. **[Mill.]**

The Rainfall of the Six Months, September, 1904—February, 1905. *With Map.*

The amount was below the average at the great majority of stations during each month of the six, and only in the west of Scotland and Ireland, and in two small areas in western England and Wales did the total reach 75 per cent. of the average.

United Kingdom—Scotland. **Barrow and others.**

Memoirs of the Geological Survey. Scotland. The Geology of the country round Blair Atholl, Pitlochry, and Aberfeldy. (Explanation of Sheet 55.) By G. Barrow, J. S. Grant Wilson, and E. H. Cunningham Craig, with Petrological Chapter and Notes by Dr. J. S. Flett. Glasgow; London: E. Stanford. 1905. Size 9½ × 6½, pp. vi. and 162. *Map and Illustrations. Price* 3*s*. *Presented by the Geological Survey.*

United Kingdom—Scotland. *Symons's Meteorolog. Mag.* **40** (1905): 29–32. **Dansey.**

The Glacial Snow of Ben Nevis. By Rev. R. P. Dansey. *Illustration.*

See note in the April number (p. 451).

United Kingdom—Scotland. *Scottish G. Mag.* **21** (1905): 264–268. **Mackenzie.**

Pigmies in the Hebrides: A curious legend. By W. C. Mackenzie.

United Kingdom—Scotland. *J. Scottish Meteorolog. S.* **13** (1905): 14–32. **Watt.**

The Rainfall of the Ben Nevis Observatories. By A. Watt.

United Kingdom—Scotland. *Nature* **71** (1905): 583–584. **Watt.**

Inversions of Temperature on Ben Nevis. By A. Watt.

United Kingdom—Scotland. *B. Assoc. Rep.* (1904): 55–60. ———

Meteorological Observations on Ben Nevis. Report of the Committee.

ASIA.

Afghanistan. ———

Index to the Survey of India Department Map of Afghanistan. Scale 1 inch = 16 miles. (No. 152-S.-01.) Compiled in the Intelligence Branch, Quartermaster-General's Department in India. Simla, 1905. Size 10 × 6, pp. 188. *Presented by the Intelligence Branch, Quartermaster-General's Department in India.*

Asia—Historical. *B.S.G. Română* **25** (1904): 80–135. **Nicolescu.**

Primul Călător Român prin Siberia si China. De Miron Nicolescu.

On the journey of the Russian ambassador Spathar in the seventeenth century.

Central Asia—Historical. *Sitzb. K.P.A.W. Berlin* (1905) (1): 238–248. **Franke.**

Hat es ein Land Kharoṣṭra gegeben? Von Dr. O. Franke.

China. *Rev. G.* **29** (1905): 175–180. **Cauquil.**

L'hinterland de Quang-Tchéou-Wan. Par Capitaine Cauquil. *With Map and Illustrations.*

China. *B. American G.S.* **37** (1905): 339–356. **Nichols.**

Notes from the Diary of the late Francis H. Nichols in China. *With Map.*

See note in the September number (p. 331).

China. *J. Tōkyō G.S.* **17** (1905): 1–5. **Ogawa.**

Geographical Researches in North China. By Tahudzi Ogawa. [In Japanese.]

China—Exploration. *Z. Ges. E. Berlin* (1905): 212–214. **Tafel.**

Filchner-Tafel 'sche Expedition. Geologische Beobachtungen auf dem Weg von Hsi-ning-fu über das Quellgebiet des Gelben Flusses nach Sung-pan-ting. Aus einem Brief von Dr. Albert Tafel.

Noticed in *Journal*, vol. **25**, p. 562.

AFRICA.

Egypt—Historical. **Petrie.**

A History of Egypt. [Vol. iii.] From the XIX. to the XXX. Dynasties. By W. M. F. Petrie. London: Methuen & Co., [*not dated*]. Size 8 × 5, pp. xx. and 406. *Maps and Illustrations. Price* 6*s. Presented by the Publishers.*

Madagascar. **Grandidier.**

Collection des Ouvrages Anciens concernant Madagascar. . . . Tome iii. Ouvrages ou extraits d'ouvrages anglais, hollandais, portugais, espagnols et allemands, relatifs à Madagascar (1640 à 1716). Par MM. A. Grandidier et G. Grandidier. Paris, 1905. Size 10 × 6½, pp. 720. *Maps and Illustrations. Price* 25*s.*

See review of first two vols., vol. **25**, p. 449.

Senegal. *C. Rd.* **140** (1905): 744–745. **Chautard.**

Sur les dépôts de l'Éocène moyen du Sénégal. Note de J. Chautard.

South Africa. **Dehérain.**

Henri Dehérain. L'Expansion des Boers au XIX[e] siècle. Paris: Hachette et Cie., 1905. Size 7½ × 5, pp. 434. *Maps. Price* 5 *fr.* 50. *Presented by the Publishers.*

A useful summary of Boer history, based evidently on a careful study of the authorities, including many original documents.

South Africa. ———

South Africa. Report of the South African Native Affairs Commission, 1903–1905. London: Wyman & Sons, 1905. Size 13½ × 8½, pp. viii. and 98. *Price* 10½*d.*

South Africa—Drakensberg. *Alpine J.* **22** (1905): 362–369. **Browne.**

Notes on the Section of the Drakensberg Mountains from Giant's Castle to Cathkin Peak. By S. G. Browne. *With Map.*

Transvaal. ———

Report of the Transvaal Department of Agriculture, July 1, 1903, to June 30, 1904. Pretoria, 1905. Size 10 × 6½, pp. 404. *Map, Plans, and Illustrations.*

Tunis. *B.S.G. Com. Paris* **22** (1900): 38-46. **Fresnel.**
Le Djérid tunisien. Par E. du Fresnel.

Uganda. *B.S.G. Italiana* **5** (1904): 1076-1089. **Castellani and Mochi.**
Contributo all' Antropologia dell' Uganda dei dottori A. Castellani e A. Mochi.

West Africa. *La G., B.S.G. Paris* **11** (1905): 97-107. **Cureau.**
Travaux astronomiques et topographiques de la Mission française de délimitation entre le Congo français et le Cameroun. Par Dr. A. Cureau. *With Map and Illustrations.*

West Africa. **Field.**
"Verb. Sap." on going to West Africa, Northern Nigeria, Southern, and to the Coasts. By A. Field. London: Bale, Sons & Danielsson, [1905]. Size 7½ × 5, pp. 166. *Map and Illustrations. Price 2s. 6d. Presented by the Author.*
See note in *Journal* for February, 1905, p. 204.

West Africa. *A travers le Monde* **11** (1905): 53-54. ———
La Mission ichtyologique de la Baie d'Arguin. *With Map.*

NORTH AMERICA.

United States—Communications. ———
Department of Commerce and Labour, Bureau of the Census. Special Reports. Street and Electric Railways. Washington, 1905. Size 12 × 9½, pp. x. and 440. *Maps and Illustrations.*

United States—Great Basin. *J. Geology* **13** (1905): 63-70. **Keyes.**
Structures of Basin Ranges. By C. R. Keyes. *With Illustrations.*

United States—Historical. **Ford.**
Library of Congress. Papers of James Monroe listed in chronological order from the original manuscripts in the Library of Congress. Compiled under the direction of W. C. Ford. Washington, 1904. Size 11 × 7½, pp. 114.

The papers date from 1779 onwards, and include a facsimile of Monroe's journal of negotiations for the Louisiana purchase.

United States—Levelling. *Science* **21** (1905): 673—674. **Hayford.**
A connection by Precise Leveling between the Atlantic and Pacific Oceans. By Dr. J. F. Hayford. [See also p. 862 of the same vol.]
See note, *ante*, p. 220.

United States—Louisiana. *Science* **21** (1905): 551-552. **Hilgard.**
The Prairie Mounds of Louisiana. By Prof. E. W. Hilgard. [See also pp. 310, 632 of the same vol., and p. 358, *supra* (Geomorphology).]
Noticed in the Monthly Record.

United States—Massachusetts. **Goldthwait.**
B. Museum Comparative Zoology Harvard College **42** (1905): 263-301.
The Sand Plains of Glacial Lake Sudbury. By J. W. Goldthwait. *With Map and Plates.*

United States—New York. *B. American G.S.* **37** (1905): 65-77. **Haupt.**
A Menace to the New York Harbour Entrance. By L. M. Haupt. *With Chart.*

United States—New York. *B. American G.S.* **37** (1905): 193-212. **Tarr.**
The Gorges and Waterfalls of Central New York. By R. S. Tarr. *With Map and Illustrations.*

United States—Place-names. *National G. Mag.* **16** (1905): 100-104. **Whitbeck.**
Geographic Names in the United States and the stories they tell. By R. H. Whitbeck.

United States—Tennessee. *J.G.* **4** (1905): 58-73. **Emerson.**
Physiographic Control of the Chattanooga Campaign. By F. V. Emerson. *With Maps and Illustrations.*

United States—Washington. *Science* **21** (1905): 392-393. **Conard.**
The Olympic Peninsula of Washington. By H. S. Conard.

CENTRAL AND SOUTH AMERICA.

Peru—Historical. **Lamprey.**

Selections from Prescott's History of the Conquest of Peru. Edited by A. S. Lamprey. London: H. Marshall & Son, 1905. Size $7\frac{1}{2} \times 5$, pp. 132. *Maps and Illustrations. Price* 1*s.* 3*d. Presented by the Publishers.*

Intended as a reading-book for schools.

Peru—Manu. *B.S.G. Lima* 15 (1904): p. 120. **Torres.**

Plano del rio Manu, y perfil longitudinal del talweg del mismo rio. Por el ingeniero Juan M. Torres. *Map and Sections only.*

A reduction of the original survey (cf. *Journal*, **23**, p. 606), but on the large scale (longitudinal) of 1 : 60,000. The scale of widths is exaggerated three times, involving some distortion, and the orientation seems incorrect, as it indicates the river's general direction as far less inclined to an east-and-west line than in all other recent maps, including the latest publications of the Junta de Vias Fluviales.

Tierra del Fuego. *B.I.G. Argentino* 21 (*n.d.*): 3–78. **Dabbene.**

Viaje á la Tierra del Fuego y á la Isla de los Estados. Por R. Dabbene.

Uruguay. ———

Años 1902 y 1903. Anuario Estadístico de la República O. del Uruguay. Tomo i. Montevideo, 1905. Size $11\frac{1}{2} \times 8$, pp. xxiv. and 764. *Diagrams. Presented by the Director-General de Estadística, Montevideo.*

West Indies—Bahamas. **Shattuck.**

The Geographical Society of Baltimore. The Bahama Islands. Edited by G. B. Shattuck, PH.D. New York: The Macmillan Company, 1905. Size $11 \times 7\frac{1}{2}$, pp. xxxii. and 630. *Maps and Illustrations. Price* 42*s. net. Presented by the Editor.* [To be reviewed.]

MATHEMATICAL GEOGRAPHY.

Mathematical Geography. **Marcuse.**

Handbuch der Geographischen Ortsbestimmung für Geographen und Forschungsreisende. Von Dr. Adolf Marcuse. Braunschweig: F. Viewig und Sohn, 1905. Size 9×6, pp. x. and 342. *Charts and Illustrations. Price* (*half-leather*) 12 *marks, and* (*unbound*) 10 *marks. Two copies, presented by the Publishers.* [To be reviewed.]

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Oceanography. **Monaco.**

Résultats des Campagnes scientifiques accomplies sur son yacht par Albert I[er] Prince Souverain de Monaco publiés sous sa direction avec le concours de M. J. Richard. Fasc. XXIX. Mémoires Océanographiques. (Première série.) Par J. Thoulet. Monaco, 1905. Size $14 \times 11\frac{1}{2}$, pp. 134. *Plates. Presented by H.S.H. the Prince of Monaco.*

Oceanography. **Raben.**

Weitere Mitteilungen über quantitative Bestimmungen von Stickstoffverbindungen und von gelöster Kieselsäure im Meerwasser. Von Dr. E. Raben. (Separatabdruck aus: Wissenschaftliche Meeresuntersuchungen herausgegeben von der Kommission zur Untersuchung der deutschen Meere in Kiel und der Biologischen Anstalt auf Helgoland, Abt. Kiel., N.F., Bd. 8.) Kiel, 1905. Size $13 \times 10\frac{1}{2}$, pp. 279–287. *Charts. Presented by the Deutschen Wissenschaftlichen Kommission für die Internationale Meeresforschung.*

Oceanography. **Stenius.**

Öfversigt Finsk. Vet.-S. Förhandlingar 46 (1903–4): No. 6, pp. 16.

Der osmotische Druck im Meerwasser. Mitteilung aus dem Laboratorium der Finnischen hydrographisch-biologischen Kommission. Von S. Stenius.

Oceanography. *Ann. Hydrographie* 33 (1905): 206–211. **Wegemann.**

Ursachen der vertikalen Temperaturverteilung im Weltmeere unter besonderer Berücksichtigung der Wärmeleitung. Von Dr. G. Wegemann.

Oceanography—Currents. *La G., B.S.G. Paris* 11 (1905): 185–190. **Bénard.**

Les courants du golfe de Gascogne. Par C. Bénard. *With Map.*

Oceanography—Mediterranean. ———.
Berichte Commission Oceanograph. Forsch. 8 (1904): 285–323.
Fortsetzung der Berichte der Commission für Erforschung des östlichen Mittelmeeres. (Achte Reihe.)

Oceanography—Pacific. *American J. Sci.* 19 (1905): 274–276. **Agassiz.**
On the progress of the *Albatross* Expedition to the Eastern Pacific. By A. Agassiz.

Oceanography—Red Sea. ———
Berichte Commission Oceanograph. Forsch. 8 (1904): 1–283.
Fortsetzung der Berichte der Commission für oceanographische Forschungen im Rothen Meere (Südliche Hälfte) 1897–1898. *With Maps and Plates.*

Sea-level. **Steenstrup.**
Kan Tangranden benyttes til Bestemmelse af Forandringer i Vandstanden? Af K.J.V. Steenstrup. (Særtryk af "Meddelelser om Grønland," 33.) København, 1905. Size 9½ × 6, pp. 8. *Plates. Presented by the Author.*

Discusses the possibility of determining recent fluctuations of level by a study of the seaweed fringe on cliffs, etc.

Seismology. **Láska.**
Ueber die Verwendung der Erdbebenbeobachtungen zur Erforschung der Erdinnern. Von Prof. Dr. W. Láska. (Mitteilungen Erdbeben-Kommission der K.A.W. Wien, N.F., No. xxiii.) Wien, 1904. Size 9½ × 6½, pp. 14. *Presented by the K. Akademie der Wissenschaften, Vienna.*

Springs. *Meteorolog. Z.* 22 (1905): 159–164. **Kerner.**
Ueber die Abnahme der Quellentemperatur mit der Höhe. Von Dr. F. v. Kerner.

Terrestrial Magnetism. *Terrestrial Magnetism* 9 (1904): 163–166. **Bauer and Littlehales.**
Proposed Magnetic Survey of the North Pacific Ocean by the Carnegie Institution. By L. A. Bauer and G. W. Littlehales.

See note in the April *Journal* (p. 462).

Tides. **Zöppritz.**
Gedanken über Flut und Ebbe. Widerlegung der herrschenden Ansichten über deren Entstehung, und Vergleich mit ähnlichen in Wassermassen auftretenden Erscheinungen. Von A. Zöppritz. Dresden: H. Schultze, 1904. Size 9½ × 6½, pp. vi. and 62. *Presented by the Publisher.*

Volcanoes. *Sitzb. A.W. Wien* 112 (1903), Abt. I.: 681–705. **Doelter.**
Zur Physik des Vulkanismus. Von C. Doelter.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Historical. **Dias.**
B.S.G. Lisboa 21 (1903): 180, 222, 291, 336, 377, 402; 22 (1904): 11, 78, 135, 160, 200, 248, 308, 339, 367, 414.

O Esmeraldo de Duarte Pacheco, edição critica por A. Epiphanio da Silva Dias.

Historical—Behaim. *B.S.G. Lisboa* 22 (1904): 297–307. **Serpa.**
Martinho de Bohemia (Martin Behaim) (Excerpto). Por A. Ferreira de Serpa.

Mamiya. *J.G., Tōkyō G.S.* 16 (1904): 541–623. **Ogawa.**
Rinzo Mamiya. I. Life and Works of Rinzo Mamiya. By T. Ogawa. II. Mamiya's Unpublished Works. 1. Report of Mamiya's Expedition to Saghalien, with Account of Matsuda's Trip to the Farthest Part of the Island. 2. Mamiya's Travel to East Manchuria ("Tōdatsukikō"). [In Japanese.] *With Maps and Plates.*

GENERAL.

Geographical Readers. **Hayward and others.**
Round the World. Tales of Travel, by C. F. Hayward (pp. 128); Land and Water, by the same (pp. 144); Our English Home, by C. W. Crook and W. H. Weston (pp. 208); Europe, by W. V. Mingard (pp. 296). London: T. C. & E. C. Jack, [*not dated*]. Size 7½ × 5. *Maps and Illustrations. Presented by the Publishers.*

See note on other vols. of the series in vol. 25, p. 236.

Geography. **Havass.**
Evénements géographiques de l'année 1903. Par Dr. R. Havass. Budapest, 1904. Size 9 × 6½, pp. [18]. *Presented by the Author.*

Geography—Text-book. **Heighway.**

Ai Vola ni Jiokarafi kei Europe kei Aferika. Sa vakarantaka ko W. A. Eiwei (Rev. W. A. Heighway), pp. 144 and xii. Ditto, kei Esia kei Amerika, pp. 84 and iv. Fiji: District Printing and Publishing Committee, 1904. Size 5 × 7½. *Maps and Illustrations. Presented by the Author.*

A text-book of geography for use in Fiji.

Year-book. **Klein.**

Jahrbuch der Astronomie und Geophysik. . . . Herausgegeben von Prof. Dr. H. J. Klein. XV. Jahrgang 1904. Leipzig: E. H. Mayer, 1905. Size 9 × 6, pp. viii. and 344. *Diagrams and Illustrations.*

Gives abstracts of many recent publications, including one of a paper by Dr. Grosser on the Andes of Ecuador, which appeared in the German publication *Gaea*, accompanied by illustrations.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Bulgaria. **Kassner.**

Isothermen von Bulgarien. Von Prof. Dr. K. Kassner. *Petermanns Geographische Mitteilungen*, Jahrgang, 1905, Tafel 14. Gotha: Justus Perthes, 1905. *Presented by the Publisher.*

England and Wales. **Ordnance Survey.**

Ordnance Survey of England and Wales:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from August 1 to 31, 1905.

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England and Wales. **Geological Survey.**

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(*E. Stanford, London Agent.*)

Germany. **Königl. Preuss Landes-Aufnahme.**

Karte des Deutschen Reiches. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheet 315, Loburg. Herausgegeben von der Kartogr. Abteilung der Königl. Preuss. Landes-Aufnahme. Berlin, 1905. *Price* 1.50 *mark each sheet.*

ASIA.

Andaman Islands. **Man.**

Andaman Islands, illustrating the Tribal Distribution. By E. H. Man. Scale 1 : 1,267,200 or 20 stat. miles to an inch. *Presented by E. H. Man, Esq.*

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 4 miles to an inch. Sheets: 36 n.w., s.w., parts of districts Panch Mahals and Ahmedabad, of Rewa Kántha and Mahi Kántha Agencies (Bombay Presidency), Banswara and Dungarpur States (Rajputana Agency), and Jhabua, Rutlam, Indore and Bori States (Central India Agency), additions to 1904, 1905. 39 n.w., parts of districts Ahmednagar, Poona, Thana and Kolaba, and of Native State Bhor (Bombay Presidency), additions to 1903. 49 n.w., parts of districts Rohtak, Hissar, Karnal, and Delhi, and of Native States Jind, Dujana, and Loharu (Punjab), additions to 1903. 55, parts of districts Buldana, Akola, Amraoti, Wun, Basim (Berar), Aurangabad, Parbhani, Sirpur, Tandur, Nander Indur, Bir (Nizam's Dominions), and Khandesh (Bombay Presidency), additions to 1903. 76 n.w., parts of districts Kurnul and Kistna (Madras Presidency), and Nagad Karnul and Nalgonda (Nizam's Dominions), additions to 1904. 114 n.e., parts of districts Burdwan, Hughly Bankura, Manbhum, Midnapore, and Singhbhum (Bengal), additions to 1904. 120, parts of districts Nadia, Burdwan, Jessore, Faridpur, Dacca, Murshidabad, Rajshahi, Mymensingh, Birbhum, Malda, Backergunge, and Pabna (Bengal), additions to 1903. 124 s.e., parts of districts Kamrup, Nowgong, Darrang, Cachar, Khasi and Jaintia Hills, and Sibsagar (Assam) additions to 1904. 125 s.e., parts of districts Sylhet, Cachar and Lushai Hills (Assam), and Hill Tippera State (Bengal), additions to 1904. 127 n.w., parts of districts Backergunge and Noakhali (Bengal), additions to 1903.—Map of Assam, 32 miles to an inch, additions and corrections to 1904.—Assam Survey, 1 mile to an inch. Sheets: 115, districts Sibsagar and Lakhimpur, Seasons 1889–92, 1898–99, 1904.—Bengal Survey, 1 mile to an inch. Sheets: (Second Edition) 153, parts of districts Ranchi and Hazaribagh, Seasons 1863–64, 1869–70, 1904; (Second Edition) 196, districts Cuttack and Puri, Seasons 1889–91, 1894–95, 1904; (Second Edition), 265, districts Midnapore and Howrah, Seasons 1870–73, 1904; (Preliminary Edition) 311, part of district 24-Parganas, Seasons 1846–49, 1904; 410 and 411, district Chittagong, Seasons 1888–93, 1904.—Bombay Survey, 1 mile to an inch. Sheets: 105, parts of district Ahmedabad and Baroda State and Palanpur, Kathiawar, and Mahi Kantha Agencies, Season 1880–81, 1904; (Second Edition) 123, parts of districts Ahmedabad and Kaira, Baroda State, and Mahi Kantha Agency, Seasons 1871–73, 1884–85, 1904; 125, parts of district Kaira, Baroda State, Kaira and Rewa Kantha Agencies, Season 1872–73, 1904; 139, Islands of Bombay and districts Thana and Kolaba, Seasons 1880–81, 1902; 182, parts of district Panch Mahals and Rewa Kantha Agency, Seasons 1883–84, 1886–87, 1902; 249, part of district Kanara, Season 1901–02, 1904; 277, districts Kanara Belgaum and Dharwar, Seasons 1887–89, 1901; 308, districts Dharwar and N. Kanara, and Native States Jamkhandi, Miraj (Senior and Junior), and Sangli, Season 1893–94, 1903.—Burma Survey, 1 mile to an inch. Sheets: (Preliminary Edition) 102, parts of districts Upper and Lower Chindwin, Seasons 1896–97, 1899–1902, 1904; 110 (New Series), parts of districts Minbu, Magwe, and Myingyan, Seasons 1891–92, 1894–96, and 1902–03, 1904; 111 (New Series), parts of districts Minbu and Magwe, Seasons

1891–93, 1894–95, and 1902–03, 1904; 112 (New Series), parts of districts Minbu and Magwe, Seasons 1891–93, 96–98, and 1902–03, 1904; 164, parts of districts Henzada and Tharrawaddi, Seasons 1884–85, 1899–1900, and 1902–03, 1904.—Central India and Rajputana Survey, 1 mile to an inch. Sheets: 171, parts of States Gwalior (C.I. Agency), Tonk and Udaipur (Rajputana Agency), Season 1875–76, 1904; 382, part of Gwalior State (C.I. Agency), Season 1862–63, 1905; 387, parts of States Gwalior, Khaniadhana, and Orchha (C.I. Agency), and district Jhansi (U.P. Agra and Oudh), Seasons 1856–57, 1868–70, 1888–90, 1895–96, 1904; 391 and 392, parts of Gwalior, Kurwai, Pathari, and Bhopal States (C.I. Agency), and of district Saugor (Central Provinces), Seasons 1856–57, 1862–63, and 1871–72, 1904; 393, parts of States Gwalior, Bhopal, Muhammadgarh, and Basoda (C.I. Agency), and district Saugor (C. Provinces), Seasons 1856–57 and 1871–72, 1904; (Second Edition) 404, parts of Tehri State (C.I. Agency), and district Jhansi (United Provinces), Seasons 1855–57, 1860–61, 1888–90, and 1895–96, 1904; (Second Edition) 469, parts of Sohagpur and Rewah (C.I. Agency), and Chang-Bhakar Tributary State (Chota Nagpur) Bengal, Seasons 1866–67, 1871–72 and 1873, 1903.—Central Provinces Survey, 1 mile to an inch. Sheet 31, parts of States Gwalior, Bhopal, Pathari, and Kurwai (C.I. Agency), and of district Saugor (C. Provinces), Seasons 1854–57 and 1871–72, 1904.—Madras Survey, 1 mile to an inch. Sheet 138, parts of districts Bangalore and Kolar (Mysore), Seasons 1876–78, 1903.—Punjab Survey, 1 mile to an inch. Sheets (Preliminary Edition) 195 and 196, districts Montgomery and Lahore (Rechna and Bari Doabs), Season 1901–02, 1904.—Sind Survey, 1 mile to an inch. Sheets 3, district Upper Sind Frontier, Season 1902–03, 1904; 4, districts Upper Sind Frontier and Larkhana, Season 1902–03, 1904; 5, 6, and 22, district Larkhana, Season 1901–02, 1904; 23, districts Larkhana and Hyderabad, Seasons 1893–94, 1901–03, 1904; 40, districts Sukkur and Larkhana and Khairpur State, Seasons 1899–1901, 1904; 43, districts Larkhana and Hyderabad and Khairpur State, Seasons 1893–94 and 1901–03, 1904; 79, districts Sukkur and Upper Sind Frontier, Seasons 1892–93, 1900–03, 1904; 91, districts Hyderabad and Thar and Parkar, Season 1898–99, 1901.—United Provinces Survey, 1 mile to an inch. Sheets: (Second Edition) 40, parts of States Gwalior and Orchha (C.I. Agency) and district Jhansi (U.P. Agra and Oudh), Seasons 1874–76, 1882–83, 1904; (Second Edition) 59, parts of Tehri State (C.I. Agency) and district Jhansi (United Provinces), Seasons 1855–57, 1860–61, 1888–90, 1895–96, 1904; (Third Edition) 65, districts Moradabad, Naini Tal and Bareilly and Rampur State, Seasons 1871–72, 1875–76, 1886–89, 1890–91, 1898–99, 1904; (Second Edition) 82, parts of districts Naini Tal, Bareilly and Pilibhit, Seasons 1888–89, 1897–99, 1904; 100, parts of districts Pilibhit, Shahjahanpur, and Kheri, Seasons 1895–1900, 1904; 134, districts Lucknow, Bara Banki, and Sitapur, Seasons 1862–64, 1865–66, 1904.—United Provinces and Central India and Rajputana Surveys, 1 mile to an inch. Sheets: 25 (U.P.), 361 (C.I. & R.), districts Muttra and Agra (U.P.) and Bharatpur State (C.I. & R.), Seasons 1856–58, 1871–75, 1904; 56 (U.P.), 397 (C.I. & R.), parts of district Agra (U.P.) and Gwalior State (C.I. Agency), Seasons 1861–62, 1873–74, 1904.—Northern Trans-Frontier, 4 miles to an inch. Sheet (Second Edition) 2 S.E., parts of Hunza Nagir (Kanjut), Sarikol and Afghanistan, Seasons 1880, 1883, 1885–86, 1888–89, 1891–93, and 1900–01, 1904.—North-Western Trans-Frontier Survey, 2 miles to an inch. Sheets: 330, parts of Afghanistan and Baluchistan, Seasons 1878–81, 1885–86, 1889–90, 1895, 1904; 428, parts of Afghanistan and the N.W.F. Province, Seasons 1878–80, 1882–83, 1894–95, 1904. 4 miles to an inch. Sheets: 27 N.E., parts of Afghanistan, Chitral, and Dir, Seasons 1894–98, 1901; (Fourth Edition) 27 N.E., part of Afghanistan, Seasons 1878–79, 1894–95, 1897–98, 1903.—Eastern Bengal, 8 miles to an inch. Sheet 16, containing parts of districts Chittagong, Chittagong Hill Tracts, and Noakhali, additions to 1902, 1904.—Bengal, District Dacca, 8 miles to an inch, corrected to 1904, 1905; District Purnea, 8 miles to an inch, corrected to 1903; District Shahabad, 8 miles to an inch, corrected to 1903.—United Provinces of Agra and Oudh. District Jalaun, 8 miles to an inch, corrected to 1904.—United Provinces: District Bareilly, 4 miles to an inch, corrected to 1904.—Lower Provinces (Bengal), District Faridpur, 4 miles to an inch, corrected to 1904.—India and adjacent Countries, 1 : 1,000,000. Sheets: (Provisional Issue) 71, parts of Nepal and Tibet, 1904; (Provisional Issue) 84, parts of Assam, Bengal, and Burma, 1904. *Presented by H.M. Secretary of State for India, through the India Office.*

Java. **Netherlands Government.**

Kaart von Java. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Residentie Kediri, 4 sheets; Residentie Madioen, 4 sheets. The Hague: Topographisch Bureau, 1905.

AFRICA.

Africa. **Topographical Section, General Staff.**

Map of Africa. Scale 1:1,000,000 or 15·8 stat. miles to an inch. Sheets: 16, Alexandria; Part of Sheet 47, Gambia; 59, Falaba; 113 and 114, Kunene river; 119, Walfish bay. *Price 2s. each sheet.*—Scale 1:250,000 or 3·9 stat. miles to an inch. Sheets: Northern Nigeria (Provisional), 51-J, K, L, N, O, 52-I. *Price 1s. 6d. each sheet.* London: Topographical Section, General Staff, War Office, 1905. *Presented by the Director of Military Operations.*

Africa. **"Weekly Summary."**

Raised Maps of Africa for the Blind, showing the Physical Features and Political Divisions, with guide. Eltham: *Weekly Summary*. *Price 1s. 9d.* *Presented by the Publisher.*

These are two thin cardboard maps of Africa, raised in a manner very similar to those modelled by the late Mr. G. Boyle for the blind. The meridians are indicated at the top and bottom of the maps by raised straight strokes, and the parallels of latitude are represented by stretching threads across the maps. The use of separate maps for the physical features and the political divisions will doubtless be an advantage. An explanatory guide, in the Braille type, accompanies the maps to assist in reading them with the fingers without the aid of a sighted teacher.

The publisher of the *Weekly Summary* (a newspaper in Braille for the blind), who has had the maps prepared, is hoping to issue a complete set covering the principal divisions of the globe, should these two prove successful and be taken up by educational authorities interested in the instruction of the blind. The price of the two maps, with guide, in one cover is 1*s.* 9*d.*

Egypt. **Survey Department, Cairo.**

Topographical Map of the Giza Province. Scale 1 : 10,000 or 6·3 inches to a stat. mile. Sheets: S.E., Nos. 10–5, 6, 7; 11–5, 6, 7; 12–5, 6; 13–5, 6; 14–4, 5, 6; 15–4, 5, 6. Cairo: Survey Department, Public Works Ministry, 1905. *Presented by the Director-General, Survey Department, Cairo.*

Mauritius. **Topographical Section, General Staff.**

Map of the Island of Mauritius. Scale 1 : 63,360 or 1 inch to a stat. mile. 6 Sheets. London: Topographical Section, General Staff, War Office, 1905. *Presented by the Director of Military Operations.*

Sierra Leone. **Topographical Section, General Staff.**

Sierra Leone Peninsula. Scale 1 : 63,360 or 1 inch to a stat. mile. London: Topographical Section, General Staff, War Office, 1905. *Price 2s. 6d.* *Presented by the Director of Military Operations.*

A clearly drawn map, from recent surveys, showing contours in brown, water blue, roads in burnt sienna.

Togo. **Sprigade.**

Karte von Togo. Bearbeitet von P. Sprigade. Scale 1 : 200,000 or 3·1 stat. miles to an inch. Sheet E 1, Misahöhe. Berlin: Dietrich Reimer (Ernst Vohsen), 1905. *Presented by Herr P. Sprigade.*

AMERICA.

Canada. **Department of the Interior, Canada.**

Map of the Electoral Divisions in the Provinces of Saskatchewan and Alberta. Scale 1 : 2,217,600 or 35 stat. miles to an inch. Ottawa: Department of the Interior, 1905. *Presented by the High Commissioner for Canada.*

The boundaries and names of the electoral divisions are shown in red. Apart from this special information, it is a good general map of the provinces of Saskatchewan and Alberta.

Canada. **Morice.**

Carte des sources et du Bassin Supérieur de la Nétchakhoh. Par le R. P. A.-G. Morice, O.M.I. Scale 1: 600,000 or 9·4 stat. miles to an inch. *Bulletin de la Société Neuchateloise de Géographie*, Tome 15, 1904. Neuchatel: Paul Attinger, 1904.

Colombia. **Compañia Fluvial de Cartagena.**

Carta Topografica del Rio Magdalena desde La Boca Ceniza hasta El Salto de Honda. Scale 1 : 177,408 or 2·8 stat. miles to an inch. 9 Sheets. Compañia Fluvial Cartagena. *Presented by Francis Russell, Esq.*

This chart of the Magdalena river has been drawn and printed specially for the use of the Compañia Fluvial de Cartagena. It shows in black outline only the course of the river between La Boca Ceniza and El Salto de Honda. No latitudes or longitudes are given, nor is there any information as to average depth of the river.

Cuba. **Habenicht.**

Cuba, bearbeitet von H. Habenicht. Scale 1 : 1,875,000 or 29·59 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang, 1905, Tafel 12. Gotha : Justus Perthes, 1905. *Presented by the Publisher.*

GENERAL.

World. **Sohr-Berghaus.**

Neue zeitgemässe Bearbeitung von Sohr-Berghaus Hand-Atlas über alle Teile der Erde. Entworfen und unter Mitwirkung von Otto Herkt herausegegeben von Prof. Dr. Alois Bludau. Früher herausgegeben von F. Handtke. Neunte Auflage. Lieferung 9. Glogau : Carl Flemming. *Price* 1*m*.

This part contains the following maps : Russia, physical, scale 1 : 9,000,000 ; South America, scale 1 : 10,000,000, sheets 1 and 3.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas. 100 Karten in Kupferstich herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha. 49 und 50 Lieferung. Titel, Inhaltsübersicht und Namenverzeichnis zur neunten, von Grund aus neubearbeiteten und neugestochenen Auflage. Gotha : Justus Perthes.

This issue, containing sheets 3 and 4 of the map of Africa, and 1 and 3 of South America, completes the ninth edition of this well-known and excellent atlas. The first part was published four years ago, and was noticed in the *Geographical Journal* for January, 1902. Many entirely new maps have been added, and the others carefully revised and brought up to date. The principal alteration in the general appearance of the maps is in the hill features, which are in this edition for the first time printed in brown instead of black, and in some respects this is an improvement, inasmuch as it renders it possible to read the place-names more readily. Still, on some of the maps the shading is somewhat rough, and the fineness of execution which characterized the earlier editions is wanting. But when it is remembered that the whole atlas, including one hundred maps, can be now obtained for 30 marks, it must be admitted that it is a most remarkable production for the money, and considering the amount of accurate information it contains, and the general excellency of the maps, the atlas deserves to be even more popular than it has been hitherto.

With this issue there also appears the index to place-names, which is most complete, and will add greatly to the value of the atlas for purposes of general reference. An extra charge of 3.50 marks is made for this index.

CHARTS.

Chile. **Chilian Hydrographic Office.**

Chilian Hydrographic Chart, No. 110, Canal Smyth, Bahia Muñoz Gamero. Valparaiso ; Oficina Hidrografica, Marine de Chile, 1905. *Presented by the Chilian Hydrographic Office.*

Guam. **U.S. Hydrographic Office.**

The Island of Guam. From a topographical survey in 1901–1902, under the direction of Civil Engineer Leonard M. Cox, U.S. Navy. Scale 1 : 56,070 or 1·13 inch to a stat. mile. Washington : U.S. Hydrographic Office, 1904.

This chart is on a large scale, and measures 44 × 32 inches. It shows a considerable amount of detailed information, not merely round the coast-line, but also in the interior of the island.

North Atlantic Ocean. **Kaiserliche Marine, Deutsche Seewarte.**

Monatskarte für den Nordatlantischen Ozean. August, 1905 (Jahrgang 5), No. 8. Hamburg: Kaiserliche Marine, Deutsche Seewarte, 1905. *Price* 75 *pfg.*

The special feature of this issue of the German official monthly pilot chart of the North Atlantic is, that on the back full particulars are given of the eclipse of the sun of August 29 and 30, accompanied by a chart. The pilot chart itself is very similar in general design and the character of the information it contains, to that of our own country and the United States.

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for August, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for September, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Kordofan. **Leveson.**

Eighteen photographs of Southern Kordofan, taken by Captain C. H. Leveson, 18th Hussars. *Presented by Captain C. H. Leveson.*

The district in which these photographs were taken extends from 9° 30′ to 12° N. lat. and 30° to 32° E. long., and includes the part of Kordofan west of the valley of the Nile at Fashoda. The photographs are specially interesting from an anthropological point of view, and the dances are extremely well taken.

(1 and 2) A Nuba mountain village; (3) Nubas of Kawarma; (4) Nuba men of Kawarma dancing; (5) Nubas of Jebel Tatcho; (6) A Nuba of Jebel Timin; (7–9) Nuba women dancing at Tira el Akhdar; (10) A Nuba woman of Acheron; (11) A Nuba woman of Ghulfan; (12 and 13) Nuba babies eating sugar; (14 and 15) Wrestlers of Jebel el Aheima; (16) A Nuba of Nyima; (17) A tebeldi tree; (8) Dinkas near the mouth of the Bahr el Arab.

South Africa. **Ritchie.**

Twenty-five photographs of the Drakensberg mountains, Barotseland, and the Victoria Falls, and eleven drawings from some Bushman's caves, taken by Captain C. Mac I. Ritchie, R.H.A. *Presented by Captain C. Mac I. Ritchie, R.H.A.*

An interesting little set of photographs and sketches, to the value of which Captain Ritchie has added considerably by the careful and complete descriptions he has furnished with them. The copies of the drawings in the Bushman's caves, in the Drakensberg mountains, are specially interesting.

(1) Head of Bushman's river; (2) Looking out from Bushman's caves; (3) Nearing the head of Bushman's river; (4) The top of Bushman's river pass; (5) Party returning from pass; (7 and 8) Victoria falls, river entering the gorge; (9 and 10) Victoria falls; (11) The "Knife Edge," Victoria falls; (12) The Zambezi in the gorge; (13) Camp on the Ingwesi river; (14) Hanging birds' nests; (15) Carriers on the march; (16) A Barotse kraal; (17) Donkey transport on the march; (18) A baobab tree; (19 and 23) A blue wildebeeste bull; (20) A Barotse carrier; (21 and 22) Catching and loading "pack-donkeys;" (24) The Zambezi at Kasangula; (25) Lichtenstein hartebeeste.—Drawings: (1) A Bushman attacking a Kaffir; (2) The leader of the community, laying down the law; (3) Bushman after shooting arrow; (4) Kaffir babies fighting; (5) Kaffir running; (6) European with gun; (7) A Bushman resting on his bow; (8) Two Bushmen going hunting; (9) An eland walking; (10 and 11) An eland standing still.

Vegetation types. **Karsten and Schenck.**

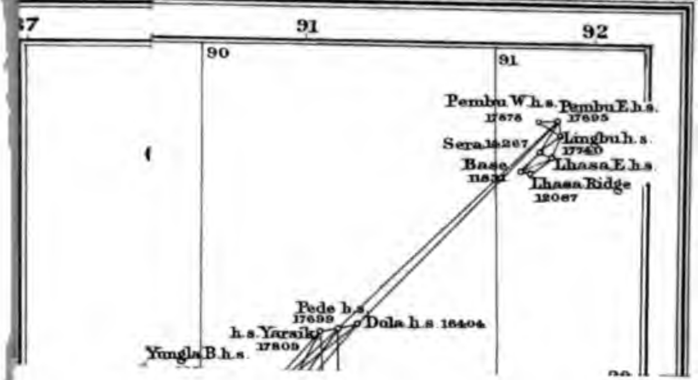
Vegetationsbilder, herausgegeben von Dr. G. Karsten und Dr. H. Schenck. Dritte Reihe, Heft 2. Russisch Turkestan. Von Dr. E. A. Bessey. Heft 4. Mittel- und Ost-Java. Von Dr. M. Büsgen, Dr. H. Jensen und Dr. W. Busse. Jena: Gustav Fischer, 1905.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

TIBET.

RYDER.

THE GEOGRAPHICAL JOURNAL 1905.



The

Geographical Journal.

No. 5. NOVEMBER, 1905. Vol. XXVI.

SURVEYS AND STUDIES IN UGANDA.*

By Lieut.-Colonel C. DELMÉ-RADCLIFFE, M.V.O.

I. The Nile Province.

In June, 1899, when at Mumias, in Kavirondo, I received orders to proceed to the Nile Province or Nile Military District, as it was then called, to take over the civil and military charge from Colonel Martyr, who had returned after having established stations at Wadelei, Lamogi, Affuddu, and Fort Berkeley. Since Emin Pasha's day, and until Colonel Martyr's expedition, the only white men to approach this part of the world had been Owen, Thruston, and Vandeleur, who pushed down the Nile in the old steel boat as far as Wadelai.

Of the stations first occupied by us, Lamogi was abandoned, Affuddu was shifted to Nimule (a better site), and Fort Berkeley was shifted to Gondokoro, as the steamers could not get higher than that point up the river at low water.

When I passed through Kampalla on my way to the Nile, Colonel Ternan, then acting Commissioner in Uganda, requested me to survey as much as possible, and lent me a very good plane-table with a telescope alidade. Besides this, I had a 3-inch mountain theodolite, a pocket sextant, and a few sketching instruments. Unfortunately, the pressure of administrative and other duties made it impossible to devote much time to survey. I measured with a steel tape a base near Affuddu, and another near Wadelai. From both of these a triangulation was extended with the small theodolite, and carried on with the plane-table. The mapping was done on a scale of 2 miles to the inch, with contours at

* Read at the Royal Geographical Society, May 8, 1905. Map, p. 592. For Map of the Nile Province, see *Geographical Journal*, vol. 21, p. 220.

100-feet vertical intervals. In the Lango country even this amount of work could not be done, and the map of this part, being based on very inadequate material, must be extremely incorrect.

Of the old station of Wadelai, on the left bank, the parapets and ditches are still in a fair state of preservation, though the buildings have disappeared. Here and there remains of the ivory burnt by Emin were found.

At Gondokoro were found the remains of the old parapets and trenches; also of Baker's gardens, with the lime trees still bearing a plentiful supply of fruit. The foundations of the old Austrian mission chapel we also discovered when excavating to make a brick-kiln. The river had encroached a little on the site of the station, and cut away half the foundations of the chapel. About 16 miles north of Lamogi is Fatiko, with the parapet and ditches of Baker's old fort almost as good as new. The walls of the stone houses, which he described, were still standing.

The natives we found remembered Emin Pasha well, but regarded him with indifference or dislike. He had left, perhaps unavoidably, a great deal of power in the hands of native subordinates, and their abuse of it had made the unfortunate people dread the Pasha's authority. Of Gordon only a few natives seemed to know anything, though most of those living near the river had heard of "Godun," as he was called. I secured one interesting relic of Gordon in the shape of an Austrian bent-wood chair which he had given to the chief Gimorro. I bought it from the latter's son, Aoin, who had fixed a patch of leopard-skin on the seat.

Sir Samuel and Lady Baker, however, seem to have inspired the natives everywhere with the greatest possible affection. They never ceased to tell us wonderful stories of the doings of "Murrdu," or Lion's-mane, as they called Sir Samuel, and of "Anyadue," or Daughter of the Moon, which is their name for Lady Baker. Many of the Bakers' old adherents came to ask us for news of them. Watel Ajus, a very aged man now, got himself carried from his village a long way to my camp. On hearing that Lady Baker was alive in England, he took an elephant's hair necklace from his neck and begged me to give it to her when I went back. This I did, and the old chief was delighted to receive a return present of photographs of Sir Samuel and Lady Baker, with an ivory-handled knife. This he acknowledged by sending back a leopard-skin to Lady Baker. Old Shooli was still very flourishing, and was most useful to the administration. Our best recommendation to the natives we found to be the statement that we belonged to the same nation as Baker, and that our government would be like his. Shooli gave me one of the scarlet shirts which had been worn by Sir Samuel's famous "Forty Thieves." He had treasured it carefully all those years in an earthenware jar, as a sort of credential to show his connection with Baker. Gimorro was dead, but his son Aoin at once became one of our most trusted native friends.

RIPON FALLS.

In all this country the most interesting natural feature is the Nile itself. Emerging from Lake Victoria by the Ripon falls, about 15 feet in height, it sweeps on to Foweira, with, on the average, 400 yards of clear water hemmed in by beds of papyrus on either bank. This part of its course is obstructed only by the low Owen falls and some minor rocky obstacles. It seems probable that steam navigation between Foweira and Lake Victoria can be made possible by a small effort of engineering in constructing locks or blasting a passage through the obstructions. From Foweira to the Murchison falls the case is different. In this part, the river is a succession of rapids, cascades, or falls. The difference of level from Foweira to Fajao in 50 miles is about 1200 feet. The falls, by which the river descends finally from the Uganda - Unyoro plateau through a gap in the eastern escarpment of the Lake Albert rift-valley, are 140 feet in height. Three-quarters of a mile lower down is the site of the now abandoned station of Fajao. At the falls the whole body of the Nile, 150 yards wide and very turbulent, is suddenly contracted into a chasm only 20 feet wide.

Rushing through this, it makes two jumps into the broad basin below. From the falls the river swirls along through a channel about 100 yards wide, between steep rocky hills covered with green and creeper-festooned trees. At Fajao it commences to widen out into a beautiful pool 500 yards across. In this the water is smooth, and flecked with the broken and snowy masses of froth from the falls. The banks are flat, and covered with tall trees clearly reflected in the water. On every rock and sandbank, and all over the surface of the pool, crocodiles are to be seen in incredible numbers—probably more than in any other single spot in the world. Hippos in the broad pool blow and grunt cheerfully, monkeys chatter at the crocodiles from the trees, a pair of African fish eagles squall in concert, a harnessed antelope creeps out from the trees opposite to nibble the green grass; after dark, a number of spine-winged goatsuckers flit like animated Japanese dragons in all directions, lions may be heard roaring on the north bank, or elephants trumpeting as they come to drink. Day and night the incessant booming of the falls completes a combination of sights and sounds likely to linger a long time in the memory.

From Fajao the river offers no obstacle to navigation all the way to Nimule. There is little doubt that the level of the water alters considerably independently of local storms or rainy weather, which do not affect it much. Time does not permit of discussing this point now. I will merely mention that it was very low in 1898, and continued falling in 1899, 1900, and 1901. We laid out gardens on some ground below the station at Nimule, in 1901. I have since heard that the river has now submerged them, which shows that it must be 6 to 10 feet higher than in 1901. When the river is low, boats drawing 3 feet of water might have difficulty in passing some of the sand-bars—one, for instance, at the southern end of Lake Rube. Just where the river enters Lake Albert a great extent of papyrus and sudd blocks the exit, though there are numerous channels through it. Again, between Wadelai and Nimule huge beds of papyrus and accumulations of sudd are met with, though generally the passage is easy enough to find. The river varies in width from 200 yards in places to a mile or two.

Lake Albert is a beautiful sheet of water. A splendid view of it is obtainable from the top of the escarpment just above Kibero—1200 feet above the lake. On the opposite side, 60 miles away, rise the steep mountains of the Nile-Congo watershed, 6000 and more feet in height. All the way along, waterfalls and cascades can be seen flashing through the dark-green covering of the mountain slopes. Away to the north can be seen the depression where the White Nile makes its exit and starts on its long journey to the Mediterranean. To the south can be seen the low swampy land at the mouth of the Semliki. Beyond this haze and cloud usually hide the huge hulk of Ruwenzori, with its snow-clad peaks, but in clear weather the spectacle is one not to be forgotten.

At Nimule the Nile passes through a narrow defile and again contracts in an extraordinary manner. There are first a series of slight rapids, and then, 2 miles from Nimule, the river rushes through the gorge of the Fola rapids about 20 yards wide and a quarter of a mile long. For the next 20 miles the fall is rapid, and rocks and islands obstruct the course of the river. The scenery about this part is very striking and worth going a long way to see.

From this on down to the Bedden rapids the river is only slightly obstructed here and there by rocks in the bed. The Bedden rapids themselves are only a few feet in height, and a little engineering would enable steamers to come right up to the mouth of the Assua river.

MURCHISON FALLS.

If this were done, nothing but the rapids in the Fola defile would prevent boats coming all the way from the Mediterranean to Lake Albert. A piece of railway 20 miles in length would suffice to link up the two stretches of navigable water on each side of the defile.

It is impossible, in the limits of this paper, to do more than cast a speculative glance at the possibility of utilizing the immense amount of power available in the falls and rapids of the Nile within the limits of the Uganda Protectorate. The discharge of the Nile is between 530 and 2300 cms. per second according to Sir William Garstin. In a country without coal, so far as is at present known, the utilization of this power for the proper development of resources may soon become a practical question, especially as the transmission of electric power to a distance is now being effected with constantly increasing economy.

The affluents of the Nile on the right bank are all periodical streams without exception. Even the Assua, which at times is a brown flood 120 yards wide and 20 feet deep, may be crossed at the dry season without wetting one's feet.

Speaking generally, the Nile province may be described as the floor of a valley sloping gradually up from the river to a height of between 3000 and 4000 feet above the sea, at a distance of 60 to 80 miles east of the river. It is gently undulating, and well intersected with streams. Only in the Lango country, between the Nile and the Assua, do these become extensive swamps, like those of Uganda. Curious isolated granite hills occur in the central portions. A very regular double chain of them encloses the double valley of the Unyame and Ayuge. Others are to be found in the Lango country, and others again in the Bari country, such as Belinian, Rejaf, etc.—isolated hills forming very conspicuous landmarks. On the left bank the escarpment recedes some distance from the river after it leaves Lake Albert, but closes in again with the fine group of mountains opposite Nimule. These culminate in the sharp peaks of Otze and Elengua, rising 3000 feet above the river and, with the group of syenite hills opposite, form the Fola defile.

The Nile province generally is looked upon as the most unhealthy part of the Uganda protectorate. But apart from malaria one may say that there was practically no disease among the Europeans.

The largest tribe in extent of distribution is the Acholi, which covers the greater part of the country between the Latuka mountains and the Victoria Nile. They extend westwards, and gradually merge into the Lango and Karamojon, with whose language and physique theirs have much in common. They are a fine, tall, well-built race, and they live in open villages as a rule; their arms are chiefly spears, and they spend a good deal of their time in the pursuit of game; they practically wear no clothes at all, except a small piece of skin as an apron, or hung over one shoulder. Married women wear a peculiar tail made of string, and sometimes a small apron made of beads. The men and women also are fond of wearing a crystal or glass spike, about 3 inches long, in the lower lip. Young men are generally very smartly turned out, wearing brightly polished metal rings on their arms and legs, also a peculiar little conical cap made of felted human hair, ornamented with beads of glass or ivory. They keep their weapons in good order, and always keep themselves very clean and well oiled.

A peculiar custom in their villages is the building of a common nursery, into which all the small children are stuffed at night, the small door being closed with a whisp of hay or piece of basketwork. These nurseries are usually raised above the ground, and are reached with a ladder, so as to be beyond the reach of hyenas. A similar arrangement on a somewhat larger scale is made for the young unmarried girls. The huts are beehive-shaped, generally very neatly and carefully built, with flounced thatching very well arranged; the huts are frequently ornamented with some device on the pointed top, or an ostrich egg. The doorways are low, and have to be entered on the hands and knees, and there are no windows. Inside, the hut is divided into portions for the storing of food, for goats, for a fireplace, a place for grinding corn, and a sleeping-place, usually raised. Around the walls they arrange large earthenware vessels, in which they preserve their valuable or destructible possessions. They ornament the walls of their houses with quaint drawings of animals, men, etc.

They are very fond of dances, and these are very picturesque; they

THE FOLA RAPIDS.

(From a photograph by Dr. Hodges.)

have a variety of figures representing all sorts of scenes, and dress themselves up to represent animals, etc. They make, in years of good harvest, a lot of beer—and drink it too, though it does not seem to do them much harm. They do a good deal of cultivation, and, though fond of fighting and of excitement, they are really an amenable people and give the administration no trouble. I may say that all the natives in the Nile Province are, now that they have confidence in us, very charming people to deal with.

The Lango are a wilder and less organized tribe than the Acholi; the young warriors wear very handsome headdresses made of cock's feathers, which resemble a guardsman's bearskin at a short distance. Another peculiar habit of the Lango is to pierce the tongue and hang a little piece of brass chain to the tip. This is the highest effort of fashion.

In the angle formed by the river where it enters and comes out of Lake Albert Edward, and along its bank as far as Wadelai, but only on the river-banks, are found the Alur. The bulk of this tribe lives on the opposite side of the river and of Lake Albert. They live chiefly on fish and occasional hippopotami or crocodiles, but they also cultivate a certain amount of cereals and beans. They resemble the Acholi in appearance, though they are not such a fine race, and are more addicted to the use of the bow and arrow than the spear.

In the corner of Unyoro, called Magungo, a very peculiar tribe is to be found which well merits examination by an anthropologist. It differs in many particulars from the tribes surrounding it. Mr. George Wilson told me that he had heard these people had a tradition resembling the story of the children of Israel and their miraculous passage of the Red sea. On inquiry among them I found this was so, the Red sea in this case being represented by Lake Albert, across which, they stated, the bulk of their tribe had escaped oppression in Unyoro by the waters opening and leaving a passage.

From Wadelai down the river on the right bank is to be found the Madi tribe. These also extend only a very short way inland from the river, and live along its banks like the Alur. They affect circular villages with parapets and ditches, often a stockade in addition, with a few narrow gateways. Their arms are spears and bows and arrows, and they live much in the same way as the Alur; their language, however, is totally distinct from that of the Acholi, and their physical characteristics differ considerably: they are a much sturdier, stouter-built race, and darker in colour than the Acholi. They extend down the Nile for some distance beyond Nimule.

North of the Madi again come the Bari, between the Nile and the Latuka mountains—another perfectly distinct tribe. Physically, these resemble the Acholi; their language is different, however; they are not so clean, do not build such good houses, and do not pursue game, or only rarely. The Bari extend north of Gondokoro, and are now a very quiet and friendly tribe, giving the administration no trouble.

The whole of the Acholi country is covered for eight months in the year with grass 6 to 9 feet high, which is burnt in December, and from then till April the whole country is open—all the game can be seen, and travelling is delightful. The greater part of the country is also sprinkled with small acacia and other trees, and studded with ant-hills. In some parts the predominating trees are borassus palms; in others kuk thorns, or again, kigelia, or again, tall butternut trees. Patches of really fine forest are rare in the country, though proper afforestation and the prevention of grass fires would no doubt give excellent results. Between the Assua river and the southern end of the Latuka mountains occurs a very large extent of dense bamboo jungle much frequented by herds of elephants. The Bari country is to a large extent open grass land with splendid large single trees studded about it, giving it a very park-like appearance.

The Lango country lies between the upper course of the Assua river and the Nile. The southern slopes from the watershed, which is quite near the Assua river, are very flat, with swamps in every stream bed, frequently a mile or two wide, and when full too deep to wade across. In the dry season the swamps disappear—even the Toshi and Kokolle rivers nearly run dry. The country to the north of the Aswa is drier, rain often fails, grass is shorter, and dry-country animals, such as zebras, ostriches, donkeys, etc., abound. The Aswa river dwindles in size to the east in a surprising manner, and it is rather difficult to realize that it comes from the Karamojon range, though this must be the case. I may mention that Lieut. Howard, who marched from Sabe, north of Mount Elgon, to join the Longo Field Force in May, 1901, informed me that he did not come across any lake or sheet of water which might correspond to the Lake Kwania, tentatively indicated in Colonel Macdonald's survey.

Throughout the Nile province red dhurra is cultivated; telebun, dukhn, Indian corn, semsem, tobacco, ground-nuts, and sweet potatoes are largely grown. Bananas are only found in one or two of the Alur settlements. This is singular, as throughout Unyoro they are grown everywhere. Round the stations we found that many European vegetables grew very well, also papai. Near the sites of Emin Pasha's old station many plants of cotton run wild were found. These showed pods well filled with long staple cotton, which would lead one to suppose that cotton might be profitably grown; the chief obstacle to cultivation in the western part of the Nile province, and especially in the Bari country, is the frequent lack of rain, but in time to come irrigation works from the Nile will perhaps remedy this. Cattle used to be kept in enormous numbers by the natives throughout the country. Sir Samuel Baker mentions villages possessing herds of from 6000 to 10,000. Rinderpest and inter-clan fighting have combined to keep down the numbers. The preventable causes removed, and provided no more natural scourges visit the country, there should be a great future in the Nile provinces for the cattle industry.

Of wild animals elephants take the first place; there are enormous herds of them, especially in the northern part, and the ivory is of the greatest size. A big herd wanders down from the flanks of Elgon, and uses a remarkable elephant road, which is apparently used only during the season of migration; it comes from the east through Lira, crosses the Assua, and so on to the Acholi country. This herd of elephants frequently crosses the Nile at the southern end of the lake-like extension near Wadelai.

Hippopotami come next in size, and are to be found in countless numbers in the Nile. When the tributary rivers are in flood they go a long way up them. Were it not for the fact that in the Nile they are extremely dangerous and cause considerable loss of life, they might well be preserved, for they do little other harm—a very small fence is sufficient to keep them out of cultivation.

Rhinoceroses occur throughout the Nile province in small numbers; they are most numerous, perhaps, in the country east of the Gondokoro. Giraffes are fairly numerous. They wander all over the Acholi country, and have been seen in the Lango country, and also in the Bari country near Gondokoro.

Of eland, I only saw one small herd near Nimule. Buffalo were almost exterminated by a visitation of rinderpest 15 years ago, but several herds now are beginning to increase rapidly. Baker's roan antelope are to be found north of the Assua river. Jackson's hartebeest is common, and north of Gondokoro, the area of the *Damaliscus Senegalensis* commences. *Kobus defassa* is fairly common throughout the Nile province. *Kobus Thomasi* is common in the Acholi country, and along the Nile near Gondokoro. Just north of Gondokoro appears to be the meeting-place of the *Kobus leucotis* and *Kobus Thomasi*; both were to be seen in the same valley, but the *Leucotis* did not extend south, nor the *Thomasi* north of the line. Some specimens were seen suggesting the idea that the two species interbreed. Reed-buck are to be found in the Acholi country, and also, but rarely, bush-buck and harnessed antelope. Wart-hog are found occasionally everywhere, and I heard from the natives of a very large variety of pig called by the Acholi "Labala"—of this animal I unfortunately never saw a specimen. Lions and leopards are fairly common in the open game country. Hyenas are, on the whole, rare; wild dogs (*Lycaon pictus*) are found, though rare, and so are jackals; serval cats are common; puff-adders and the black-necked cobra are the commonest snakes, though in the Lango country pythons must be numerous, judging from the number of drums we found with the drumheads made of their skin. Ostriches and zebras occur in the north of Lira, and are said to be common to the east of the Latuka mountains.

The rainy season, I believe, normally commences in April, though during the time I was on the Nile, it hardly rained at all except during the last year. In normal seasons it rains for about two months, and should recommence about September, but the second rains are not so heavy as the first.

The Nile provinces are considerably warmer than Uganda, in consequence of the general elevation being 2000 feet lower. It is sometimes very hot in the valley of the river, and at Gondokoro the temperature occasionally exceeds 100°; but, speaking generally, the country cannot be called hot in the sense of the hot weather of India.

Later on, when the development of the administration will enable the stations to be placed further east on higher ground, delightfully cool and healthy sites will be available; in the Latuka country, for instance, the mountains reach a height of 9000 feet above the sea.

The communications in the Nile provinces were somewhat primitive, but are being improved now. In 1899–1900 the natives, by my orders, cleared a broad road all the way from Fajao to Gondokoro, and another from Wadelai to Nimule, *viâ* Lamogi. But these roads require constant looking after, as they get easily overgrown. A launch and a large steel boat now run between Lake Albert and Nimule; a telegraph line is being carried towards Gondokoro. There are several points between Foweira and Lake Albert where a comparatively short bridge could be built across the Nile. Bridges about 150 yards long would be required over the Assua, Khor Gana, Khor Kit, and shorter ones for the other streams.

There is no serious engineering obstacle to the construction of a railway either along the Nile bank or a little further inland, and there would be still less in carrying the line through the swampy plains from Gondokoro all the way to Fashoda. If Sir William Garstin's magnificent scheme for canalizing the Nile between Bor and Fashoda is ever carried out, the waterway for steamers would be immensely improved, a splendid embankment for the railway would be provided, and, lastly, many millions of acres of good soil would be reclaimed from the swamps—and all this apart from the chief object of the scheme, which is to largely increase the water-supply for Egypt.

The anthropology, ethnology, and languages of the Nile tribes, all offer subjects of study of the greatest interest. I compiled a glossary of about a thousand Acholi words, but time was lacking to do more. Now that the Church Missionary Society are starting stations in the province, it is to be hoped that these tribes will be exhaustively studied.

II. The Anglo-German Boundary Commission west of the Victoria Nyanza.

In July, 1902, after a short leave in England, I returned to Mombasa for the purpose of commencing the work of the Anglo-German Boundary Commission west of Lake Victoria. My companions on this occasion were Major Bright and Lieut. Behrens. In East Africa we were joined by Captain Harman. Captain Laughlin and Sergeant-Major Rehm also joined the commission for a short time. Dr. Bagshawe was in medical charge, and at my request undertook the botanical collection. Colonel Hayes Sadler, H.M. Commissioner for the Uganda Protectorate, also lent me the services of Mr. Doggett as taxidermist and collector.

The German commission consisted of Captain Schlobach and

Lieutenants Schwartz and Weiss. In addition, the German commission had Feldwebel Buchner—a first-rate surveyor—and a civilian geodetic technician, besides a sergeant in charge of the office. It would be difficult to find more agreeable comrades than our colleagues of the German commission, and the personal relations between the members of the two commissions were always of the happiest.

The task before the commissions was to carry the longitude from the coast to the west side of Lake Victoria, and then to survey topographically a strip of territory between the lake and the Congo Free State boundary, along the 1st parallel south latitude, sufficiently wide to enable a readjustment of the conventional boundary to be discussed. As a starting-point on the coast, Ras Kadamoni, on the mainland opposite Mombasa town, was indicated, and the Admiralty values for the latitude and longitude of this spot were accepted by both Governments.

On our arrival at Mombasa, we found that, owing to a misunderstanding, Captain Schlobach had gone right up to the western end of the boundary, on the Congo Free State border, instead of meeting us at the coast. Telegrams were sent after him, and he returned to Entebbe.

A few days were spent at Mombasa in making a small base and triangulation to connect Ras Kadamoni with the temporary observatory on the railway station platform at Mombasa, on the island where the end of the telegraph was, disembarking stores, only a portion of which had come out with us, and in enlisting porters. The latter proceeding offered no difficulty, as hundreds of men who had served with me before on the Nile and elsewhere offered themselves; the difficulty lay in the selection. In the end a splendid body of men was got together.

I then started for Entebbe, with Lieut. Behrens and one hundred porters. We reached the lake in two days by train—a contrast to the three months' journey it used to be. In two days more we were at Entebbe by steamer, and found Captain Schlobach and the German commission.

Our original instructions were to the effect that the longitude of Entebbe was to be determined by exchanges of telegraphic signals with Mombasa. Accordingly, the German commission left for the coast to work at Mombasa, while we remained at Entebbe. We worked night after night, but it was found impossible to get signals through on the section Port Florence—Entebbe. The line was in every way unsuitable. Originally only a telephone line, it was incompletely insulated. Earth currents continually affected the wire. Every thunderstorm in the neighbourhood, also, and an incessant crackling in the instrument, indicated lighting somewhere on the line. Besides this, white ants destroyed the poles; tall grass grew up over the wires; trees drooped their branches on to it, or the poles took root and enclosed the wire in bushy growths; cattle and wild animals upset the pol s when rotten ;

grass fires damaged both the poles and the wire; finally, an elephant went off with half a mile of the wire round his neck, eventually strangling himself after a terrified flight through Usoga. The dead body was found 40 miles from the line by some natives. We therefore had to give up this bit of the line, and we proceeded to make the exchanges over the Mombasa—Port Florence permanent line.

To save time, I hired a launch for the trip to Port Florence from Entebbe. As luck would have it, the engines broke down in the open lake. We fortunately got them to work again in a couple of hours, and just ran in to the opening of Kavirondo bay as a terrific storm came on. During the night we ran ashore some miles south of Port Florence, but got there safely in the end.

Two complete series of exchanges were made with the British commission at Port Florence, and then the commissions changed ends to repeat the process. By this means the effect of personal error was eliminated. In the end the longitude of Port Florence was determined with a very small probable error. The work was subjected to most tiresome delays. During September it was possible to make exchanges on two nights only, and on both these nights the complete programme was carried out. During October exchanges were possible, so far as the weather was concerned, on the nights of the 7th, 9th, 18th, 20th, 21st, and 28th. On the 18th and 28th the programmes were successfully carried out; on the 7th and 21st the results were spoilt by interruptions of the telegraphic communications; on the 9th, by an accident to the instrument at Mombasa during the time observations; on the 20th, by the telegraph clerk going to sleep and failing to give the call from Port Florence.

The weather throughout was particularly unfortunate—the rainfall during September and October was unusually heavy, and so it continued during the subsequent work. The actual figures were for October, 10·30 inches of rain in fifteen days, as compared with an average of 2·37 for this month during the ten years from 1891–1901. The rainfall in September was equally abnormal. The two stations where the astronomical observations had to be carried out were most unfavourably situated as regards the meteorological conditions. Mombasa is on the sea-coast, and the drift of monsoon clouds from the south-west was almost incessant. The occasions when observations were made can only be regarded as corresponding to larger gaps than usual in the cloudy pall. At Port Florence the mornings were generally very bright and clear, but towards evening the clouds rolled down towards the lake from the Mau plateau in the east, culminating, as a rule, in a violent storm about sunset, and covering the sky with dense masses till dawn, when it would clear, and the sky remain almost cloudless till noon. The incessant watching and waiting at night—for whenever a glimpse of stars could be seen observations were taken on the chance of turning out useful, or for latitude, or to rate the chronometer—and the equally continuous work all day were trying to both commissions; it had to be proceeded with, though, because an opportunity lost might have meant weeks of further waiting. But every one found that odd hours of sleep snatched in the daytime were, in the long run, a poor substitute for regular nights' rest.

During September the missing baggage and instruments arrived at last, but even then we did not get them without accident. Some boxes were dropped into the sea while being landed at Mombasa, and then the baggage-train coming up-country turned over and rolled down an embankment. The goods were put on another train, which did just the same thing. Our baggage did not suffer much, luckily, but an unfortunate horse died from being left upside down for two days in a horse-box. The line has much improved since then, and trains run up steadily and well now.

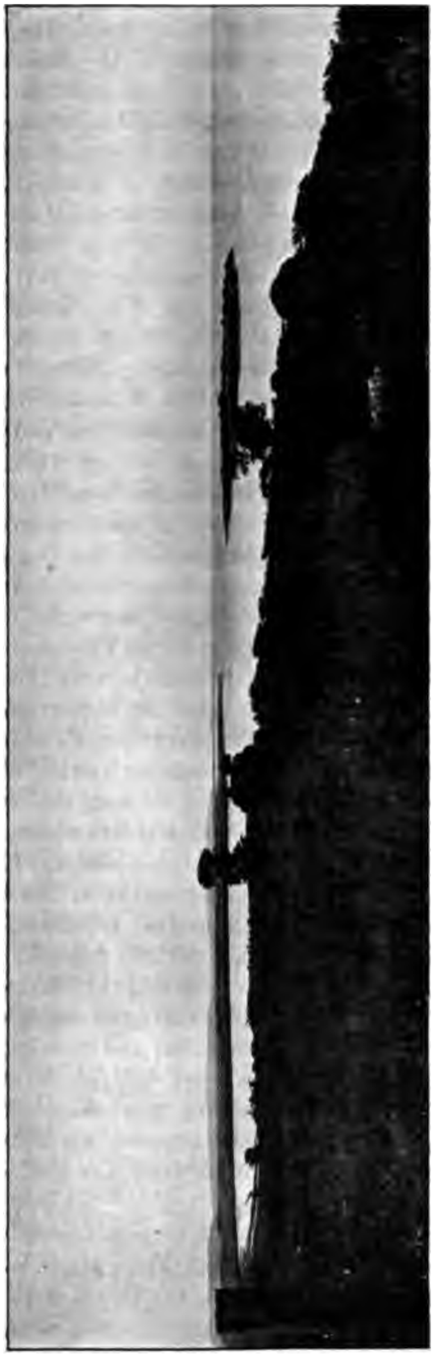
As the wire between Port Florence and Entebbe was useless, a provisional determination, by transport of chronometers, of the difference in longitude was made by one officer from each commission. The bulk of the two commissions commenced a triangulation from Entebbe to the mouth of the Kagera river. This was interrupted by dense haze, and, after waiting for some time, we gave it up temporarily, and moved on to our base camps at Mizinda to measure the base and make the observations for latitude and longitude, and to commence the survey along the 1st parallel S. latitude. To assist in the triangulation, I had obtained the loan of a party of signallers with heliographs from the Indian battalion of the King's African Rifles, and this party proved most useful all the time they were with us.

A base very well laid out by the German party near Mizinda, 6954·196 feet in length, was very carefully measured by both parties, and an extension observed. Latitude and azimuth observations were made at Mizinda. This work was all delayed by haze, but by the middle of January we moved, with every available theodolite in both commissions, to reoccupy the triangulation stations and complete the portions between Entebbe and Mizinda. This had almost been accomplished when the haze descended again, stopping observations for another twenty-three days. During this time a long cutting through dense virgin forest had to be made to allow two triangulation stations to be mutually visible. The line was laid out on a bearing, and the work continued day after day. The ground undulated through the forest, streams had to be crossed, and it was never possible to see far forward or back. It was, therefore, a great relief, when the haze lifted, to see the beacon appear, and exactly opposite the centre of the opening.

Both commissions carried independent triangulations from Mizinda to the Congo Free State boundary. The British triangulation north of the 1st parallel was laid out in quadrilaterals all the way, and closed on to a base 8658·5 feet long at the west end. A large number of secondary poin's was fixed, and a strip 20′ in latitude wide was topographically surveyed on plane-tables on a scale of 1 : 100,000. The area amounted to about 3000 square miles. The heights of the main triangulation stations were fixed by reciprocal observations, and the detail of the features was shown by sketch-contours referred to mean sea-level at 100-feet vertical intervals. The usual routine of work was to start out at daybreak, stop work for an hour for lunch at midday, and then go on working till dark. The return journey to camp at night was often rather difficult over the rough ground, and sometimes I did not get in till ten or eleven o'clock. More than once I bivouacked for part or the whole of the night. To be caught in one of the usual terrific thunderstorms on these occasions leaves a vivid but not agreeable impression. A large portion of the country was very difficult to survey, but the work was finished by the middle of January, 1904. Delay had been occasioned by the periodical dense haze and by rain on 139 days. Also by the fact that I was laid up with fever for two months, and that Major Bright had to be invalided to Entebbe. Both commissions returned from the west of the lake in January, 1904, leaving each an officer behind to complete the building of the boundary pillars, which were put up along the conventional boundary. We then proceeded to carry out the last stage of the work—the completion of the triangulation between Entebbe and Port Florence.

When Major Bright had sufficiently recovered to return to work, he was sent on from Entebbe to select the triangulation stations, to put up beacons at all of them. The result was that the observations of this portion of the triangulation laid out in quadrilaterals were very quickly made. We stopped on Buvuma island, near the centre of the long chain of triangulations, for three weeks to make latitude and azimuth observations, and then brought the triangulation straight in to Kisumu. I took the northern line of stations, and Major Bright the southern. Dr. Bagshawe accompanied the northern party, which travelled in eleven days 72½ miles by canoe and 145½ miles by land, total 218 miles, or 20 miles per day. During this time my observations were made at fifteen different triangulation stations, each set of observations taking as nearly as possible three hours to complete. The weather was clear, and though it often rained, it was lucky that the observations were delayed only once by rain. At Kisumu another base, 5476·78 feet long, was measured and connected up with the triangulation. Latitude observations had been made at Port Florence, and azimuth observations were now made at Kisumu.

Thus a triangulation, starting from the base at Kisumu, extended all the way to Mizinda, closing on to the base there. From Mizinda another triangulation extended to a third base near the Congo Free State border. Both triangulations were laid out in quadrilaterals, with sides of from 10 to 30 miles. The triangular errors were dealt with



MIZINDA HARBOUR.

by Clarke's method of least squares, and the final computation showed the first triangulation, 260 miles long, to close on the Mizinda base with a discrepancy of only 2·97 feet, and the second triangulation, of 130 miles, to close on the base in the west, with a discrepancy of less than 5 inches. The three sets of latitude and azimuth observations were combined by the triangulation, and give a good mean result.

The ends of the bases at Mizinda and near the Congo Free State boundary have been permanently marked, as well as all the main triangulation stations between these points. The remaining triangulation stations will be marked by the Uganda and East African Protectorate administrations. They will thus be available for the extension of future surveys.

The harbour at Mizinda is of especial importance, as it is the only harbour on the west side of Lake Victoria within British territory. It is formed by the indentation of the coast-line known as Kabanyaga bay, which is completely protected to the eastward by Busungwe island. The northern entrance is narrowed by the fan-shaped bar thrown out by the Kagera river at its mouth. This bar reduces the entrance of the harbour to a narrow width of deep water, and is an effective protection against the gales from the north-east. As the water is only from 3 feet to 4 feet deep over it, the seas rolling in from the lake break up on the bar. The southern entrance is also narrow, with deep water. Mizinda point, projecting slightly into the harbour, further improves the protection, and a pier run out at this point would enable steamers to come alongside without difficulty. The gales from east and south-east, coming from the open lake, are extremely violent on this coast. For the security of shipping on the lake, a good harbour is of the utmost importance. All the requisite conditions are amply fulfilled by Mizinda harbour.

The lake-shore north of Point Chiasimbi is very swampy, and impracticable for landing except at the mouth of the Bukora river. This river, coming from the small lakes in Ankole, is choked with papyrus and reeds throughout its length, but can be navigated in canoes through certain winding channels. Near the mouth are a landing-stage and a canoe ferry to the other bank. From just south of Chiasimbi point to the mouth of the Kagera river extends a beautiful beach of white sand resembling that of the sea, backed with parklike country, with woods and groups of fine trees. At Mizinda point a sharp projection of rocky ground occurs, forming a cliff about 150 feet in height on the eastern edge. Busungwe island, on the eastern side of the harbour, is rocky, uninhabited, and partially covered with vegetation and groups of trees. From Mizinda point southwards extends another long white sandy beach as far as the mouth of Luanyega bay, which forms another splendid harbour, but within German territory. From here southwards towards Bukoba, the lake-shore consists of steep rocky headlands with small indentations. Here and there only can sufficient shelter for canoes be found.

(*To be continued.*)

THE FRENCH ANTARCTIC EXPEDITION.*

By Dr. JEAN CHARCOT.

I AM fully sensible of the honour conferred on me by the Royal Geographical Society—an institution so universally and justly esteemed —in asking me to read before it a paper on the French Antarctic Expedition. I look on this honour, not so much as a deference paid to the expedition itself and its results, as to the efforts made to secure them. No possible comparison can be made between our little excursion and the great and brilliant English expeditions, and it is not

* Read at the Royal Geographical Society, June 26, 1905. Map, p. 592.

without a certain trepidation that I venture to address you on our achievements within a few months of the return of the *Discovery* and the *Scotia*. Nevertheless, I have not hesitated to accept the opportunity offered me, knowing that you will make every allowance for our shortcomings, and take into consideration the great material difficulties that we have had to overcome.

In our country, which yields to none where there is question of explorations in Africa, in Asia, and in South America, polar expeditions had been neglected; hence even the present undertaking was favourably received only by a very small circle. It had, moreover, to be prepared somewhat hastily, and that with extremely limited means, especially at the moment of departure. I hope that in future matters will be arranged quite differently, and that henceforth France will take her part with the other great nations in the peaceful struggle against the unknown. Such co-operation cannot but tend to draw closer the ties between peoples that should be animated by feelings of mutual esteem and friendship.

Owing to the limited means at our disposal, the programme adopted by me was correspondingly modest, for I went on the principle that it would be better to employ all our resources in thoroughly exploring a narrow corner, and thus securing trustworthy documents with accurate observations, than wandering listlessly up and down the seas, exhausting our efforts in haphazard researches which might prove more satisfactory to our vanity, but would assuredly have been far less useful to science.

You will easily understand me, when I say that it is impossible to give you the exact fruits of our mission within scarcely a fortnight of our return. Our packages, with notes, documents, and collections, have not yet been opened, and the fortnight has been almost entirely occupied by me in visits and in taking the steps which were required after such a long absence, and have been almost as tiring as the preparations for the expedition, certainly more so than the expedition itself. Many long months will be needed to arrange all my scientific observations, years almost to classify and study the collections, and, even as regards the geographical studies and discoveries, I think it would be premature to give results that cannot claim finality until we have carefully gone over our notes and observations, and looked up and studied all the original charts of previous expeditions in the same regions, since it seems to us that these charts will have to be considerably enlarged and modified by our researches. Hence I hasten to assure you that the chart which you have now before you must not be considered as anything more than a mere sketch, hurriedly drawn to enable you to follow the various sections of our voyage. I think I may claim that, thanks to my associates' zeal and competency, the scientific documents brought back by us are not inconsiderable. But it will be for the savants who may have to examine them to give their opinion on their value.

I will accordingly here give you a mere summary of our labours. As for our account of the life itself of the expedition, I would ask a public accustomed to the story of the great polar epopees to excuse me for dwelling a little on that aspect of the subject. I have to state with almost a sense of shame that, owing to circumstances quite beyond my control, we had to set out without a single person experienced in the navigation of ice-fields, so that you may be interested in knowing how we managed to get through at all. Necessity is the mother of invention, and we may sometimes learn something from the shifts to which the ignorant are driven when forced to struggle through

PANORAMA OF WANDEL, WITH THE BAY WHERE THE "FRANÇAIS" WINTERED.

difficulties without the aid of precedents of which they have no knowledge.

Our general programme was to survey the north-west coast of the Palmer archipelago (Haseau, Liège, Brabant, Antwerp islands); to study the south-west entrance to the Gerlache strait; to search for a land wintering station in that region as far south as was possible with the state of the pack-ice; to make excursions in spring, and in summer to continue the exploration of Graham Land, with a view especially to elucidating the question of the Bismarck strait, and following this coast as far as Alexander I. Land. During the whole of this campaign we had to occupy ourselves with the various operations for which the expedition had been equipped. In a word, we had to continue and complete the labours of the Gerlache and Nordenskjöld expeditions.

To carry out this programme, I had built at St. Malo a small ship of 245 tons, well fitted for the work it had to do. Built entirely of oak, strength was the first consideration; the berths were well protected against cold, and special care was taken to provide proper accommodation for the laboratory, chart-room, and other installations. Thanks to its build, the ship was quite seaworthy and well suited for navigating the ice-fields. Unfortunately the engine, the best we could get for our money, was not strong enough for the work to be done, and its defects had to be made good by the skill and energy of men and officers. The navigating and scientific instruments, partly bought by me, partly lent by the Government or given by private persons, proved entirely satisfactory. I took special care with the clothing, provisions, and supplies of all sorts; and I may say that in these respects few, if any, expeditions have been better equipped than ours. The provisions were abundant, greatly varied, and of prime quality, partly prepared in France under our inspection, while certain specialities were procured in Germany, England, and the United States.

Our staff comprised six unpaid officers, and the crew fourteen men, including five sailors, three stokers, a cook, and a steward, all French except one Italian—an Alpine guide. Of the staff, M. A. Matha had charge of the hydrographic department—astronomic observations, chronometers, study of tides and currents, density and salinity of the marine waters, and terrestrial gravitation; Mr. J. Rey, of meteorology, terrestrial magnetism, and atmospheric electricity; M. P. Pléneau, of photography; Dr. J. Turquet, of zoology and botany; M. E. Gaurdon, of geology and glacial phenomena; Dr. J. B. Charcot, of bacteriology; and the captain of the *Français*, medical duties.

We sailed from Havre on August 15, 1903, and after a series of mishaps reached Buenos Ayres on November 16. For the warm reception received from the Argentine Republic, both on our arrival and return, I shall always have to speak in terms of the deepest gratitude. Nothing could exceed its generous welcome, and the accomplishment of our task is certainly in great measure due to the Argentine people. At Buenos Ayres we were lucky to meet Nordenskjöld, to whom we submitted our programme, which met with his approval. Then, a few days before our departure, we made the acquaintance of the worthy Mr. Bruce on his return from the first part of his interesting expedition. We left Buenos Ayres on December 23, and after stopping a few hours at New Year's island to pick up the five dogs lent us by the Argentine Republic, we reached Ushwaya, where an Argentine transport, driven from its route, brought our coal and our last despatches.

On January 26 we touched at Orange bay, the point where the French mission of the *Arromanche* passed a whole year (1882–83), and carried out those interesting works known to you. After taking some observations ashore and making sundry researches, we set sail on January 27.

After a fairly smooth passage despite two days of high gales, we landed at Smith island (South Shetlands) on February 1, and here came upon our first icebergs. Then we made for Low island, passing the site of the Williams reef, which we may almost say has no existence, since on our return we again passed the same spot without seeing it, though the weather was quite clear on both occasions.

I find it impossible to give you the substance of my log-book without mentioning at least the chief names of my precursors in the regions we are now about to enter.

In 1819–21, Alexander I. Land was discovered by Bellingshausen. Foster (1828–29) was followed by the remarkable expedition of Biscoe (1832), to whom belongs by right all the west coast of Graham Land. Our countryman, Dumont d'Urville (1837–40), led the way for the German whaler Dallmann (1873–74), who reported the strait by him named Bismarck, besides various other points in the Palmer archipelago. In 1893–94, thanks to quite exceptionally favourable weather in the month of November, the whalers Evensen and Pedersen were able to approach nearer to Alexander I. Land than any other navigator. Lastly, in 1897–99, the well-conducted Belgian expedition under Gerlache marks an era in Antarctic expeditions, distinguished by the discovery of Gerlache strait and the leader's first wintering station.

On February 2, 3, 4, 5 we coasted the north-west side of Palmer archipelago, and made a rough survey of its hydrography. During those four days we were greatly impeded by snow-storms and fogs, and especially by troubles with our boiler. Numerous Balænopteræ were met. On the 6th, continuing the same course, and passing many reefs and icebergs, we entered Biscoe bay, and during the night anchored off Cape Errera. On the 7th, making our way in splendid weather through numerous floes, we reached Flanders bay, but could find neither anchorage nor shelter, its shores being covered with a thick fringe of ice. We then made for Lemaire channel, but were baffled by the winds and floes, and had to return to Flanders bay, where we managed to moor the ship to the banquise (ice-fringe) by means of the ice-anchors. Here we remained eleven days, repairing the condenser and boiler, and making a few short excursions round about.

On the 19th we set sail and went in search of a good site for erecting a cairn on Wincke island. Next day we found a suitable position in the Neumayer channel, where we raised the cairn, and not far off passed the night in a little inlet with good anchorage, close to a rookery of penguins. This place, being too sheltered, would be of no use for taking observations during the winter.

On the 21st we entered the Lemaire channel, which, however, we found blocked with ice in the latitude of the southern extremity of

Wandel. We then tried to turn this island, but after passing it found ourselves again ice-bound, and had to return, anchoring in a little cove which we had noticed when passing.

On the 22nd we again essayed to advance southwards, and reached an eminence amid the floes and reefs, from the summit of which we clearly saw that no advance was then possible in that direction. So we returned to Wandel, where we remained two days patching up the boilers. Starting on the 25th in search of the Biscoe islands, we forced our way through the ice, and by nightfall reached the relatively open sea. On the 26th we again encountered a banquise near Pitt island, and tried to penetrate through the ice to the neighbouring islands.

On the 27th, our efforts to make Graham Land being thwarted by the increasing thickness of the ice, and finding no shelter under the cliffs, we had to retrace our steps, and next day again doubled Pitt island. But here, being struck by a fierce squall from the north-east, we had to remain four days at the north-east cape, enveloped in snows and fogs and beset by icebergs.

On March 3rd the fogs lifted, and, a calm setting in, we again made Wandel island, anchoring in the old inlet. The season being now advanced, and all our efforts having failed to find another shelter, we decided to pass the winter in this haven, which abounds in seals, cormorants, and penguins, and is well sheltered from all points except perhaps the north-east. Here, also, we could easily land and set up all the structure needed for our operations, and for our safety in case of any damage to the ship.

I had one of the anchor chains drawn across the inlet and made fast to the rocks on both sides in order to stop the drifting ice, and this in its turn served as a breakwater against the northern winds. The ship, which was thus thoroughly protected, had some 6 or 7 feet of water at its prow, and over 20 at the stern, so that there was nothing to fear from the large icebergs.

We at once set to work with our winter installations, fixing our portable house, and in the ice close by excavating two large stores roofed with shingles and canvas. Here we stowed the provisions, and constructed two Eskimo snow-houses, which also served to keep meat and a reserve stock of seal, which was largely consumed both by the men and exclusively by the dogs. The large whale-boat reversed afforded shelter to the petroleum casks, and the smaller boats were kept ready to be launched at a moment's notice for excursions and fishing.

Two structures, one in stone and canvas-roofed, the other in wood with copper riveting, both provided with plastered sandstone pillars and covered with marble slabs, served for magnetic observations. Another pillar, enclosed in a tent, was intended for observations with the quadrant or sextant. Corresponding arrangements were made on board, and the chain drawn across the inlet was so firmly fixed that it successfully resisted the attacks of the ice drifting against it in the form of floes and even little icebergs piled up to an incredible size. Still the swell driving before the fierce north-easters at times caused not a little anxiety, especially for the safety of the ship. But it was soon found that, thanks to the trend of the current, the lightest southern breeze, and even a mere calm, sufficed to clear the inlet of the accumulated ice, however thick it might be, except in the month of July. We were surrounded with ice formed on the spot, and, in the spring, with floes and the *débris* of icebergs which had accumulated and become cemented together over a large area. I consider that, if a vessel were minded to winter again at Wandel, it would be in perfect safety if it took the

THE HOUSE LEFT BEHIND AT WANDEL.

same precautions as we did. It would need to be provided with a powerful wire hawser or chain cable fitted with floats, the whole kept ready to be stretched in front of the chain, at a distance of some 20 yards, and so to imprison the ice. The southerly winds, being always less violent, and being besides kept off by the shelter of the land, would never have sufficient force to break the dyke so formed, as we were able to ascertain from our experience with simple rope moorings. There is no fear of being boarded by really large icebergs, on account of the slight depth of water in our bay.

A road sufficiently wide to allow of the passage of the sledges was speedily made at the outset, affording an easy communication with the land. Under these conditions the winter was passed in complete security, apart from certain alarms on the occasion of storms from the north-east, and in the most perfect comfort. Besides the plentiful stores taken with us, the seals, killed in some numbers at the beginning of winter and kept in the ice, never failed us, though it should be noted that we sometimes went several weeks without securing any. The meat is excellent, and the fat proved very useful for melting large quantities of ice. At Hovgaard island there are many more seals than at Wandel, but, except at Flanders bay, we never saw any but single individuals or small groups of from two to six. The cormorants, which were equally good eating, never left us; while the penguins, although they abandoned their rookery at the beginning of winter, frequently returned to the island in some numbers, except in August and September. During the whole winter the sheath-bills (Chionis) lived around the vessel like chickens or pigeons, eating the fragments thrown overboard. Lastly, we obtained a considerable number of good fish, either from the open water or from holes made in the ice, not to speak of the barnacles easily gathered from the rocks.

The scientific work was prosecuted without intermission throughout the winter, and to the satisfaction of all, thanks to the comfortable and convenient equipment of the vessel. We also took care to provide occupation and amusement for the men apart from their regular work. In the evenings we held classes for them, and I even gave them a course of instruction in English. Concerts, lectures, or readings of poetry also took place on Sunday evenings. Perfect harmony prevailed, and the best of spirits and good humour were maintained throughout the expedition. From April 27 to August 15, in order to make the most of the scanty daylight, the ship's chronometers were always set so as to mark five o'clock at the moment when twilight ceased, and as this harmless fraud was perpetrated from day to day, the crew were not even conscious of it.

The winter was relatively mild, the lowest temperature having been $-38°$ C. ($-30°·4$ Fahr.); but the variations were excessively sudden, a rise from $-30°$ to $-3°$ C. ($-22°$ to $+26°·6$ Fahr.) within a few hours being no uncommon occurrence, and always bringing in its train violent gales from the north-east, accompanied by snow and hoar-frost, and often lasting a long time. Winds from other quarters were never very violent, and were generally acompanied by fine weather. In summer the temperature was nearly always comparatively low, and if the north-easterly gales were of less duration, they were, on the other hand, much more frequent. During the winter, as far as we could see in Belgica strait, the water was constantly open, although often encumbered by floes and icebergs. The open sea to the west and south-west was frozen as far as we could see, but an expanse of several miles, at one time open, at another frozen, but always impassable either on foot or in boats, separated us from this pack-ice. To the south the ice appeared more stable, from Hovgaard island onwards, but ice of the strait which separated us from this island was constantly, within a few hours, being broken up with the north-easterly gales.

It was not till May 12 that we were first able to venture on this ice, but it was again and again broken up after this, and though we had reached Hovgaard on May 30, we could not do so again until July 4. During July we continued our preparations for a forty days' trip which we meant to undertake on August 15, but on the second of that month the ice was once more broken up, and in spite of all our efforts we did not succeed in reaching Hovgaard in a whaleboat until September 6. We arranged a comfortable shelter under a rock, and deposited a month's provisions, but just then the pack to the south

LEMAIRE CHANNEL.

became impracticable. I returned to Hovgaard on October 24, on a thin floe, and this was entirely broken up by a gale only a few hours after my return.

On October 28 we undertook a several days' excursion in a whaleboat, and formed a depôt. We had very bad weather throughout the early part of November, but on the 10th M. Gourdon and the guide Dayné effected the difficult ascent of one of the peaks of the southern massif of Wandel island. Numerous other excursions were made, but the state of the ice and the bad weather proved great hindrances. On November 24 our usual party, consisting of two sailors, with MM. Pleneau, Gourdon, and myself, started in the whaleboat, which, with twenty days' provisions, weighed 9000 kilos. (20,000 lbs.). From the first we had a struggle with the ice, and during almost the whole excursion we had to draw the boat along over ice which hardly bore its weight, and covered with a thick layer of melted snow, which forced us to walk with the water up to our knees. Often we had to break the ice for long distances in front of the boat, getting frequent baths as we did so. During the twelve days that this strenuous labour lasted we worked from ten to eighteen hours consecutively, economizing our food as much as possible. We reached an island south of Cape Tuxen, and, favoured by very clear weather, we were able to survey and photograph from six different points the whole coast from Wandel to the Biscoe islands. The strait which was thought by De Gerlache to possibly exist behind Cape Tuxen has really no existence. However, I can almost say for certain—as our hydrographical labours seem calculated to show—that the entrance to the Bismarck strait, reported by the German whaler Dallmann in 1873, exists in pretty much the spot where he placed it; only the general direction of the strait itself, which has been merely indicated by geographers at a venture, is not that given on our maps, especially that of Stieler.

Meanwhile work was actively prosecuted on board the ship, which remained fixed in a wide and thick field of pack-ice, but this began to loosen at the edges, and the ship commenced to open a channel. At the same time the guide, Pierre Dayné, ascended to the summit of the southern massif of Wandel. On December 10 the channel in the ice was begun by means of melinite, and by the use of saws, spades, and crowbars. On the morning of the 17th it reached the stern of the vessel, and as the ice was no longer supported, it began to float away under the impulsion of a strongish south wind, and the ship became completely free. A renewed trial of the boiler having given just enough pressure, there was nothing to delay the start for Wincke island, in order to change the record before continuing our explorations, when once we had secured a fine day for the completion of certain observations. We left behind at our winter station, a small house in sections, measuring 10 feet by 11 feet 6 inches, about 200 litres of alcohol, 375 boxes of condensed milk, 50 of sorrel, and a boat. We left also the magnetic observatory, with its pillar inside, as well as the pillar outside the stone house.* The tide *datum* was a horizontal line with the letter F above marked on a perpendicular rock at the point M of the plan which we left.

On December 25, the men made merry around a Christmas-tree brought with us from France. Our bay had for two days been somewhat blocked, but a change of wind during the night caused the ice to move away rapidly. At 8 a.m. the fires were lighted, and we hastened to get on board the cables, ice-anchors, etc. At 5.30 p.m. we set sail,

* The observations taken on these pillars are marked C. B. ("Cabane en bois") and P. E. ("Pilier extérieure") respectively.

and made the passage in fine weather with a breeze from the south-east, though occasionally obliged to force our way through the ice. We thus arrived without difficulty at the small bay where we had already anchored in February (Wincke island, Neumayer channel).

Here we were detained by a southerly wind, which caused the ice to accumulate at the entrance to our anchorage, and also brought with it bad weather. The guide Dayné and Jabet ascended a peak in the neighbourhood, while Gourdon and I ascertained that the cairn placed by us in Neumayer channel was in good condition. Gourdon also crossed a pass which gave him a view of Belgica strait, then free from ice. On January 3 a gale from the north-east began to free the entrances to our bay, and the following day, it being calm, although the barometer continued to fall, we started at 3 p.m. and changed the record left in the cairn on Neumayer channel as we passed. Becoming enveloped in fog, we entered Scholaert channel somewhat by guess-work, and getting a glimpse, when the fog lifted, of a wide and deep bay on the port side, we decided to seek shelter in it, as the weather was very threatening. The bay was surrounded by high ice-cliffs, and filled with floes and icebergs of all sizes. We found no anchorage or place where we could moor the ship, but, being well sheltered by the surrounding mountains, we remained under steam in the lee of a small island.

The next day, January 5, some strong gusts from the north-east compelled us to seek the excellent though dangerous shelter of the ice-cliff. We made an attempt to start at 3.30 p.m., but were driven back to our shelter until the next morning, when, in fair weather, we entered Scholaert channel and did some hydrographical work at several stations. Coasting the north side of Antwerp island, we steered west, avoiding the breakers through which we had passed unconsciously in February during a fog. There was a strong swell from the north-west, and icebergs were numerous, while in the evening we had to force a way through some 3 miles of heavy pack. On the 7th we put out our fires, and, with the help of a north-easterly breeze, steered south-east with all sails set. At 6 a.m. we saw clearly the summit of Mount William, and, skirting the ice within sight of the coast, came in sight of one of the most northerly of the Biscoe islands. On the 8th we had north-easterly squalls, with snow, and, scudding with three sails set, had a narrow escape as we passed between two huge icebergs. Two days later we took advantage of a fine interval to steer more to the south, but the weather and the ice soon became as bad as ever, and we held on to the south-west. The men had a hard time, the ropes and deck being covered with ice, the sea choppy, while snow and fog succeeded each other without a break.

On the evening of January 11 we reached the edge of very close pack-ice, which was studded with numerous icebergs, and extended as far as we could see. We sounded, and found a depth of 250 fathoms. At 8 o'clock there appeared to the south-east a very high land—Alexander I. Land. During the night we remained at anchor, and the following morning continued along the edge of the pack-ice, which we had little hope of being able to enter. However, at 1 a.m. on January 13, in spite of the great swell, the large ice-floes, and icebergs, we cut into the pack. Our advance was very slow, and before long the ice became so compact that we were unable to move. To reach the land was absolutely impossible, and it was with great difficulty that we freed ourselves. In the evening we again saw Alexander I. Land, and a high summit much nearer was observed to the south-east. Shortly afterwards a long chain of mountains was visible still further to the east. I decided to continue along the pack to the eastward in the endeavour to find a weak place which might allow us to reach the land.

At 8 o'clock on January 14, we perceived a rocky triangular summit a comparatively short distance away, in the direction in which we were steering. Early the following morning we attempted to force our way into the very compact and extended ice which separated us from the land, which now seemed to stretch away to the eastward in the form of a promontory. This is a high chain of mountains on a base of ice and snow, a continuation of that which we had seen in the previous evening. With great difficulty we managed to force our way into the ice, and scarcely a mile from the land we found a narrow channel of open water. The coast appeared to form a cliff of jagged ice, and presented no point at which it was possible to land. We steered towards the promontory to the east, with the intention of approaching the land from the south-west, if the channel did not close up.

We proceeded some 10 miles, and were about a mile from land when, in passing a large tabular iceberg of more than 150 feet high, the ship received a terrible shock, striking four or five times with great violence and freeing herself before the engines, which had been reversed, could produce any effect. The bows were taking water, and the pumps were immediately got to work. Our situation was a bad one, as no landing could be made on this coast, and other submerged rocks might be encountered; besides, there was the possibility of the ice closing up, and if it was necessary to continue pumping, it would be impossible to risk wintering on board, so it became urgent that we released ourselves from the ice quickly. We could not count on our engines, as they had been damaged, but, favoured by a north-east wind, and profiting by the small channels, we proceeded with infinite caution to retraverse the pack-ice. Several hours of clear weather fortunately permitted us to accurately fix our position, and survey and draw carefully this new but inhospitable coast. While thus engaged the pumps were kept working, each taking his turn willingly, following the good example set by MM. Pléneau and Gourdon, who worked with the men.

In spite of our damage, we decided to try and regain one of our known anchorages, and continue as much as possible the hydrography of the coast. The state of the ice and our damaged condition would not allow us to proceed further south, at least for the moment, so it remained for us to continue the work in the region where we were, and even a little to the north.

On January 19 we steered towards the land, which we were soon able to distinguish, and at 10 a.m. entered a large bay enclosed by large islands, separated from us by thick pack-ice, which we endeavoured to pierce, but its thickness increased, and the icebergs came so close that we gave up the attempt. No opening could be seen anywhere,

CORMORANTS.

and neither the coast nor islands appeared to offer a landing-place. The weather became stormy, and the wind blew strongly from the north-east; but although we were surrounded with icebergs, we were comparatively sheltered by the pack and the islands, which were evidently Biscoe islands, and we decided to remain here during the gale. In the morning the weather cleared, and we left our anchorage and steered towards the north, following the edge of the pack, only to encounter heavy seas and thick fog, which lasted three days.

On January 24, during a short clearance we saw to starboard some breakers, then a reef, and further away a cap-shaped island surrounded by reefs, probably the most northerly of the Biscoe group. On January 26 we saw Mount William to the south-east, about 75 miles distant.

We continued along the land in the direction of Scholaert channel, of which we wished to complete the hydrography. Whilst the weather permitted, we continued the survey we had already begun of this channel, and fixed the position of the group of islands.

On January 29 we entered Belgica strait, but a strong wind from the south-west retarded our progress, already none too rapid, but shortly after midday we anchored in a small harbour, which we had provisionally named Port Penguin.

The men were weakened by the excessive fatigues of the hard voyage we had made, and the results of the winter had made itself felt upon their health. Nearly all were enfeebled and ate little; but none complained, and kept in good spirits. From February 8 to 11 the weather was magnificent, but up till then it had not ceased to be bad. The men were able to rest and nurse themselves, these last days of sunshine especially benefiting everybody.

The repairs to the engines were finished, and, profiting by the transparency of the water, we were able to estimate the damage to the bows of the ship, which was serious enough, perhaps more serious than we had thought.

While in this excellent harbour everything was put in order on board the ship, and the water-tanks filled. Every day we fished and caught a score of large and excellent fish. The guide Dayné and the storekeeper Jabet accomplished in twenty-two hours a very laborious and dangerous ascent of the highest summit of Wincke, about 5000 feet. I decided to give to this peak the name of Louis de Savoie, the first man to climb it being an Italian.

On February 11 we tried our engines, which worked almost satisfactorily, and enabled us to weigh anchor and proceed to Biscoe bay. Favoured by magnificent weather, we reached the end of the bay before a rocky peninsula, which is almost certain to be the place where Biscoe landed. We took several photographs in the historic bay, which Biscoe would certainly have done had he had a camera. In the evening we regained our anchorage.

We afterwards returned through Belgica strait, where we again had to struggle against fog and bad weather from the north-east, and after remaining to make a survey of the narrow channel which separates Liege island from Brabant island, we followed the coast of Hoseason island, discovered by Foster in 1829. We landed near Cape Possession, where various work was executed, and after a rapid survey of the neighbouring islands, which agrees with that of the commander of the *Uruguay*, Captain Galindez, we said *Au revoir* to the Antarctic, leaving the last iceberg at Low island.

We anchored on March 4 at Puerto Madryn, where we learned with surprise of the anxiety which prevailed on our account, and I take advantage of this occasion to thank all those who have sought to reassure us, and in particular Mr. Bernacchi, from whom I have contracted a large debt of gratitude.

It was my intention to tell you, at the beginning of this meeting, that it is impossible to give you for some time the scientific results of our expedition; however, I shall be pleased to send the Society a list of the work done, together with some of the results which are already known.

Hydrography.—A regular triangulation, departing from a measured base, has been effected from our winter quarters, the island Booth-Wandal, in a radius from 2 to 5 miles. From the extreme stations of this set of triangles we were able to take bearings of different peaks

CAPE RENARD.

from 30 to 40 miles distant, which will permit the placing of these points with considerable accuracy. On these positions rest the compass surveys executed afterwards, either in the changes of the ship's position, or on the spring journey to the south. A region of 30 to 50 miles around Wandel island was thus determined by triangulation.

The other positions of the coasts surveyed were determined by means of positions at sea resting on astronomical observations. These are—to the north, the exterior contour of the Palmer archipelago and Scholaert channel; to the south, Biscoe islands and two still unknown portions of Graham Land, of about 30 miles each. It is interesting, in regard to the islands bearing his name, to remark that Biscoe only fixed Pitt and Adelaide islands, and was content to indicate between these two islands a chain of smaller islands covered with an ice-cap. Pitt island is given in three different positions in English and German publications and in the Admiralty charts. These positions differ between them, either 1° in latitude or longitude. The result is a great uncertainty about the position of Biscoe islands, which Gerlache passed without seeing in that which is assigned to them on the British Admiralty charts. We have not obviously been able to survey these islands completely, the straits which separate them being completely blocked with ice, but we have been able to fix their exterior contour, giving their breadth, which is the most important point for navigation. They lie close to Graham Land. The survey of the exterior coasts of the Palmer archipelago completes entirely the geography of that region, in conjunction in the north, centre, and south with the map of Gerlache strait drawn by the *Belgica* expedition. We were able to identify to the north Hoseason island and Cape Possession, determined by Foster and Kendall in 1829; to the south, Bismarck estuary, sighted in 1873 by the whaler Dallmann, and undoubtedly before him by J. Biscoe, who landed there in 1832, in the bay which bears his name, probably on the same rocks where we had a hydrographic station.

Finally, we were able to set, on good astronomical observations, the bearings of Alexander I. Land, to which the ice prevented our approach.

The rate of the chronometers was determined during the winter by means of the sextant observations of M. Claude. Our chronometers were kept in an almost constant temperature, and maintained a very regular rate. One may hope in deducing, by the comparison of the time of arrival and of departure, an exact longitude for our winter quarters.

Tides.—The *régime* of tides was studied by means of a registering tide-gauge, which was working for about six months. The tides are feeble (about 5 feet being the maximum), but very regular, contrary to the nautical instruction in vogue. The cause of this irregularity is, that they have a *régime* of diurnal preponderance, while the tides in the neighbourhood of Cape Horn and South Georgia are semi-diurnal. Treated by the method of harmonic analysis of Prof. Darwin, the observations of the fifteen first days served to predict with considerable exactness the tide of a day determined five months later. The observations collected will allow us to calculate, by the above method, the principal waves composing the tides at the point studied. We took also some tidal observations at two other points—Wincke island and Flanders bay.

Colour and Density of Sea-water and Sea-ice.—During our winter, samples of sea-water and sea-ice, at different periods of formation, were collected and tested during the voyage. The density was measured by means of a Buchanan areometer; the proportion of chlorine by the Mohr-Bouquet de la Grye method.

Gravity Observations.—We possessed one of M. Bouquet de la Grye's comparison pendulums, by means of which seven series of measurements were made in Wandel island. Similar measurements were made in Paris by means of the same instrument placed under the same conditions. The comparison of duration of oscillation, with all corrections made, should give the force of gravity at Wandel island to correspond with the figures observed at Paris.

Of the meteorological studies, which were carefully conducted, the chief results are—low summer temperatures, great and sudden thermometric changes, frequent north-east and east-north-east squalls, with thermometer high and barometer low; fair weather with gentle south-south-west breezes, with low thermometer and high barometer (mean about 30 inches). Lastly, in fine weather, very great regularity in the diurnal variation of the hygrometric conditions, a variation identical with that observed at Cape Horn.

Polar auroras very rare and faint.

It is interesting to compare the simultaneous chaıacter of our meteorological records with those of Año Nuevo, and of the observatory established at the South Orkneys.

Terrestrial Magnetism.—This study consisted of absolute observations of D., I., and H., and in hourly observations of D. and H. The monthly diurnal variation of these two elements was determined by at least two series of twenty-four hours. A few disturbances were also studied.

The curves obtained are merely an amplification of those of Cape Horn. They will enable the isolated observations previously made in the Antarctic to be approximately systematized.

In atmospheric electricity the two main results are—about 70 volts per metre for the difference of potential between two points of the atmosphere, and very strong electric tensions during most of the north-east squalls. Besides the measurements of tension, we studied the loss, in the atmosphere, of the electricity with which objects were charged. The apparatus employed were those of Elster and Geitel. We carried out the same studies as those made by the Danish Mission to Cape Thordsen.

Zoology and Botany.— In these branches our observations and researches have been most fruitful. Both the zoological and botanical specimens collected come from the various stations visited—Flanders bay; Wincke island; Wandel island (winter station); Biscoe bay (Antwerp island), and another bay in that island; lastly, Hoseason island. Fishing with line, trawl, bag, and net yielded numerous specimens of the inshore fauna and flora, and this class of collections was completed by many excursions along the coast.

The cetaceans, several species of which were met, formed the subject of a few observations.

The seals, very numerous in these regions, and represented by four known species, gave occasion to some interesting notes. Of these, a number of specimens have been brought back in the form of skins, skeletons, and skulls.

In our collections, birds are represented by one hundred specimens, consisting of skins, fledgelings, embryos, eggs, etc. Other members of the animal kingdom were captured by means of the above-mentioned fishing-gear.

The fishes, taken in considerable numbers down to depths of 200 feet, represent some fifteen species. On the collection of invertebrates, Prof. Joubey states, "As far as one can judge after a few hours' inspection, and after a rapid arrangement of the materials in large sections, a rough estimate may already be formed of the interest presented by the very numerous objects brought back by Dr. Charcot.

"An attractive feature of this collection is the fact that it comes mainly from shallow inshore regions in the Antarctic. From this point of view, it fortunately completes the work of previous expeditions, such as that of the *Belgica*, nearly all the captures of which were fished up from depths of from 200 to 300 fathoms. Thus, so far as regards the marine invertebrates, these two expeditions, far from going over the same ground, complement each other in a very happy and useful way. I should not like to make even a superficial estimate of the objects received in my department. Still, I may point out a very fine series of echinoderms, including some sea-urchins, star-fish, and crinoides, all not only new, but most interesting from the morphological standpoint. There is also a fine series of annelides, of worms, of nemertes and planaria, besides a considerable quantity of all kinds of parasites—intestinal worms from seals, birds, and fishes. These materials promise to yield highly interesting discoveries.

"The molluscs are remarkable for some magnificent nudibranches, and new or extremely rare shell-fish. The sea-anemones, the octopuses, squids, and medusæ form a remarkable group, if not in number, at least for their novelty.

"A vast number of ascidians, including some most curious forms, have been obtained from the surface down to a depth of 60 fathoms. These ascidians are likely to yield important discoveries.

"I find it impossible to say anything about the brachiopods, the cephalopods, the innumerable polyzoa, and a superb collection of sponges. Of all this we can for the present form no more than a general impression—an impression that the Antarctic littoral fauna is being unveiled.

"In the class of insects are comprised specimens of Diptera and Hemiptera. The crustaceans are represented by numerous individuals belonging to the groups of copepods, amphipods, schizopods, and isopods. Several species of acarides have been found in the mosses, while others are parasites of the birds. From the pantopods were also produced some good specimens."

In botany a great mass of materials was gathered amongst the algæ, representing the groups of florideæ, theophyceæ, chlarophyceæ, and oscillariaceæ, besides numerous species of diatoms. Special attention was given to those of the pack and fringing ice. During our land and climbing trips we secured specimens of mosses, lichens, and freshwater algæ. Lastly, two species of phanerograms were discovered in the Antarctic islands. The first was a grass, the *Deschampsia* (*Aira*) *antarctica*, found in Wandel island (65° 5′ S.) and in Biscoe bay; the second a caryophyllacea, the *Colobanthus crassifolius*, var. *B. brevifolius*, Engler, found only in Biscoe bay (Antwerp island, 64° 50′ S.).

Geology.—Notes and observations on the geological constitution of

DUKE OF ABRUZZI PEAK, WINCKE ISLAND.

the explored regions. Physical geography of the lands traversed. Specimens of the rocks, of the glacial muds, of the sands and gravels of the seaboard. Photographs of the surface relief. Glacial action, erosion, weathering.

The region traversed consists essentially of crystalline rocks, and especially of granites. There are no sedimentary formations, nor any fossils. Hence the chief interest is petrographic, and we have brought back somewhat numerous specimens of the rocks. Iron pyrites abounds in these rocks, and the relief of the mountains is continually modified by their sub-aërial oxidation and transformation into limonite, and by the disintegration of the rocks which have already been greatly weathered by the action of frost. The relief takes the general form of steep ridges sharply outlined with a main north-east to south-west trend, broken by fissures at right angles with their direction, and forming fjords on very low hills. The microscopic examination and chemical analysis upset the relation that might be established between these ranges and the Cordillera which bends round from Chile into Tierra del Fuego, and is apparently continued by the South Orkney islands.

Notes on the movement of ice, especially in the bays near the winter station; formation of the marine ice in those bays.

Notes on the movements, dimensions, and transformations of the icebergs; table icebergs.

Thickness of the fringing ice; its formation and destruction.

Constitution of the glacial headlands in the islets of the archipelagos west of Graham Land.

General direction of these islets.

Notes on the glaciers of Danco Land and of the Palmer archipelago; their progress and discharge.

Ascent of a summit in Wandel island, and exploration of the mountain crest in that island.

Bacteriology.—Bacteriological analysis of the sea-water, of the air, ice, and snow.

Numerous cultures (in good condition till the present time) derived from the analysis of the sea-water and of the intestinal fauna of the seals, birds (penguins, gulls, cormorants, petrels), and fishes.

Rubbings and preparations; numerous objects preserved.

Collection of photographs, forming geographical, hydrographical, meteorological, zoological, and other documents.

Photographs of the installations of apparatus during the winter.

Medical Observations.—A serious case of myocarditis which occurred at the winter station. On some circulation troubles which may possibly be attributed to Bright's disease. General survey of the sanitary condition of the expedition.

Before the paper, the PRESIDENT said: I now have the honour to introduce to you Dr. Jean Charcot, who has been good enough to come over from Paris to read to us a paper on his Antarctic work, from which he has only just returned. The general outlines of his voyage are well known to all of you who study attentively the *Journal* of the Society. But I expect that you do not know the full extent—in fact, you cannot know the full extent and value of his work until you hear Dr. Charcot's account that he is going to give us to-night. I have no doubt that many of you must have felt with us keen anxiety at the beginning of this year about the safety of the expedition. You will remember the reports that were brought back to South America and telegraphed home by an Argentine gunboat as to the probable loss of all concerned; and I remember vividly a day in last March—I was living in France at that time—when I took up the *Matin*, which, as you remember, was the newspaper which contributed so largely to the expense of the expedition, and found in it a telegram announcing the safe return of Dr. Charcot and all on board. I need not tell this audience that the name of Charcot has been long a household word in this country, where the reputation of the late

Dr. Charcot is, I think, as firmly established and as widely known as it is in his native land. There is no need for me here to expatiate on the extraordinary merits of that great man, whom we all lament. But Dr. Jean Charcot, his son, was not content to live only in the reflected light of a great name; he is himself an eminent bacteriologist, besides being a recognized authority in other sciences more or less connected with his own profession, which is that of medicine. Fortunately for geography, Dr. Jean Charcot is also an enthusiastic yachtsman, to which amusement he has devoted a good deal of his time, and it was as a yachtsman that he went three years ago to the island of Jan Mayen, within the Arctic circle, which, as we know, very few expeditions have gone to, and which may perhaps have given him a taste for Antarctic exploration. It is now three years since—no, two and a half years—since Dr. Charcot determined to promote the advancement of knowledge by organizing and personally conducting this French Antarctic Expedition. He himself contributed, I may tell you, the greater portion of the expense of that expedition. This threefold combination of scientific competence, of pecuniary generosity, and of personal service is sufficiently rare to merit our admiration, and I think that it furnishes one more proof, if proof were needed, of the general truth of that old French proverb, "Bon sang ne peut mentir." We welcome Dr. Jean Charcot here as an explorer and geographer all the more cordially on this occasion because our minds are still full of interest in another Antarctic Expedition of which this Society was the principal promoter and organizer, and yet I think that we welcome him, perhaps, now even more warmly as the distinguished representative of the scientific spirit and of the courageous enterprise of our great and friendly neighbour, France. It is a pleasant thought that the only rivalries that now exist or that are at all likely to exist in the future between the two countries are peaceful rivalries, and long may those peaceful rivalries continue for the benefit of the two countries and of the world at large. The thought is all the more pleasant because we have lived through a period of about twenty years, during which the sudden opening up of a vast continent—the great continent of Africa—inevitably produced rivalries of a very different kind, and I may confess, personally, that during those twenty years the words "a French Expedition" did not arouse in me that warm desire for its success which we have all felt in watching the progress of the voyage of Dr. Jean Charcot to the Antarctic Regions. Well, I do not think that as good geographers we ought to regret the rivalries or even the jealousies of those twenty years, because those were the incentives that produced innumerable expeditions from which we have derived an immense amount of geographical knowledge, and that geographical knowledge remains for the benefit of mankind now that the political rivalries of those bygone days, those forgotten days, have vanished like last year's snows before the warmth of the *entente cordiale*. I now call upon Dr. Jean Charcot to deliver his address.

After the paper, Captain R. F. Scott said: I do not know that I can say many words, except to thank the lecturer for his delightful paper. All of you, I am sure, have been intently interested in it, but none can have been so interested as I and those of my companions who were in the *Discovery* with me who are here to-night. There is a great bond in the ice. Dr. Charcot and I talked over it at dinner, and we agreed that if a French expedition goes one way and an English another way, and if we meet, that then there will be a cordiality that has never been realized yet, even in the *entente cordiale*. To show the importance and the interest of it to me, I may say that throughout the lecture there has not been a picture or a remark that Dr. Charcot has made to which I have not wished to say, "Stop and explain," and I assure you it is quite like old times to have seen those icebergs on the screen again. I think I may say we all thank Dr. Charcot most cordially for his paper.

Mr. BERNACCHI: It has been most interesting to listen to the lecture delivered by Dr. Charcot this evening, and I may say that I am especially interested in the French Expedition, because it was my very great pleasure some months ago to be invited to Paris to give an address on our recent experiences with the *Discovery*. I endeavoured, at that time, when there were some fears prevailing in France with regard to the fate of the French Expedition, to point out that at that early period there was no necessity for any grave fears with regard to its fate. Fortunately, those sanguine views were fully realized. But at the same time I took the opportunity, the modest opportunity, of speaking at some length of our experience and discoveries in the Antarctic, and the remarks that I made were received with appreciation and applause, notwithstanding the fact that I spoke French with an accent that it would be kindness to describe as somewhat faulty. Geographically, there is a point that rather strikes one on looking at the admirable photographs that we have seen to-night, and that is the strong resemblance between the Antarctic land in the direction south of Cape Horn and the land of South Victoria Land; that is to say, those lands are as heavily glaciated as the lands that we discovered in latitudes between 70° and 80° S., indicating, on account of the considerable difference in latitude, a possible severer climate on that side of the Antarctic than the one prevailing south of Australia. But even more interesting than the geographical results are probably the scientific results. Unfortunately, it is impossible to produce the full result of those scientific observations, but there are many new facts that I feel sure are of extreme interest; the remarks that Dr. Charcot has made with regard to the tides, for instance. I think that considerable light will be thrown, when those observations are combined with the observations taken on the *Discovery*, on the tidal phenomena existing near the south pole; and also the gravity observations, when combined with our gravity observations and those taken on the German Expedition, ought to throw considerable light on the gravity conditions prevailing in the southern hemisphere. But what has struck me most to-night, and, I think, must have struck every one here, is that Dr. Charcot and every member of the French Expedition has been actuated by that grand motto of Prince Henry "the Navigator," "*Le talent de bien faire*," that is, the desire, the wish, the keen enthusiasm to do well, which spells success.

Dr. WILSON: I think the best thing that I can do is to say as little as possible, except to add my quota of thanks to the extremely interesting paper which Dr. Charcot has put before us. Each of us had his own work in the *Discovery's* expedition, and as mine lay amongst the birds and the seals, I should like just to take this opportunity of saying that the photographs which we have seen this evening were most interesting as representing the birds of that part of the Antarctic. They were birds, in some cases, which we never saw at all. The birds of the Antarctic vary from one part to another, and such things as sheath-bills, of which we saw beautiful photographs just now, and of the cormorants, we saw nothing. It is, therefore, exceptionally interesting when we get papers of this sort dealing with different parts of the Antarctic which show different aspects of the same question. I think that the less I say the better now at this late hour, and I can only add my thanks to my appreciation of the work which Dr. Charcot has done.

Dr. MILL: I desire to reflect the wisdom of Dr. Wilson and say very little, but as a student of the history of Antarctic exploration, I must express the gratification it gives one to see the French flag once more in the southern ice. The French were leaders in Antarctic work at an early date, though many of their most interesting voyages have been almost forgotten. The cruises of Bouvet, Kerguelen, and above all of Dumont D'Urville, are full of interesting features, and their gallant attempts, both south of Cape Horn and on the other side south of Australia, are things that could not be forgotten. It is delightful to see how the scientific enthusiasm of Dr. Charcot has enabled him, with extremely slender resources, to get very fine results indeed. I look forward particularly to seeing the determinations of longitude, especially with regard to that extremely interesting group the Biscoe islands, which have been drifting about on the chart in a way which might almost suggest that the moving ice was carrying them from their moorings. I hope, when Dr. Charcot's chart comes out, we shall have the whole of the Palmer archipelago clearly defined, and that will be a great service indeed.

The PRESIDENT: I do not know if any one else wishes to address the meeting; if not, I would propose a vote of thanks to Dr. Charcot and one of his companions whom I understand is present to-night. I need say nothing about the great pleasure that Dr. Charcot has given us. The way in which his paper has been received speaks for itself.

Dr. CHARCOT: I thank you exceedingly for the very kind reception, and the kind words that have been said to me, and I will, when I am back in Paris, tell all those who came with me, staff and crew, of the way in which we were received, and they will be exceedingly gratified. There is one thing certain, namely, that the applause goes more to them than to myself. Certainly I should not have done what I have if I had not been seconded in such an excellent way. And as Captain Scott said, if we could get two expeditions—an English expedition coming from King Edward's Land, and a French expedition coming from President Loubet's island, I can promise Captain Scott the French crew would do its best, and I think it would do good work.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

PART IX.—THE LOCHS OF THE SHIN BASIN.

IN this paper it is proposed to deal with the lochs visited by the Lake Survey draining by the river Shin and river Oykell into the Dornoch firth, viz. Lochs Shin, Merkland, a' Ghriama, Fiodhaig, Gorm Loch Mòr, Ailsh, Craggie, an Daimh, Migdale, and an Lagain, and it has been found convenient to include also Loch Buidhe, flowing by the river Fleet into Loch Fleet, lying to the north of the Dornoch firth. The drainage area to be dealt with is indicated on the small index map shown on p. 521, and extends from Tarbat Ness on the east to Cnoc a' Choilich (little more than 3 miles from the shores of Loch Broom) on the west, and to Ben Hee and Carn Dearg on the north, the total area being about 860 square miles, of which about 770 square miles drain into the Dornoch firth, and about 90 square miles into Loch Fleet. Of this total about 240 square miles drain into the lochs under consideration, as will be seen from the summary table at the end of this paper. The

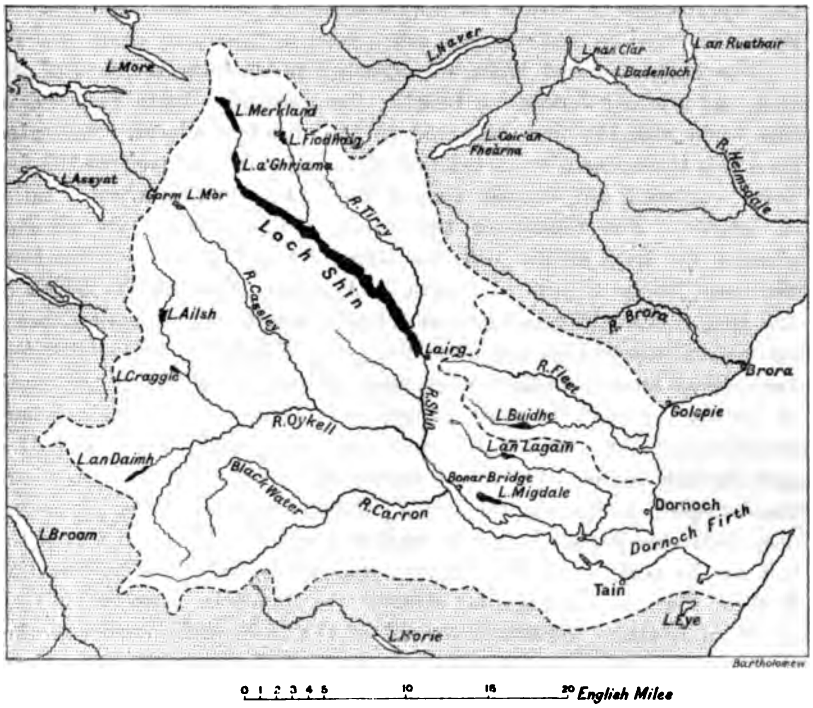
* Plates, p. 592.

principal loch is Loch Shin, one of the largest of Scottish lochs, the others being comparatively small, Loch Merkland being the only one exceeding 2 miles in length. Loch Shin receives the outflow from Lochs Merkland and a' Ghriama at its northern end, and the outflow from Loch Fiodhaig about 5 miles down on its eastern shore. Gorm Loch Mòr lies at the headwaters of the river Cassley, a tributary of the river Oykell, and Loch an Daimh flows by the river Einig into the river Oykell, which also receives the outflow from Lochs Ailsh and Craggie. The river Shin, bearing the outflow from Loch Shin, joins the river Oykell to form the Kyle of Sutherland at the head of the Dornoch firth. Loch Migdale flows by a short stream into the Dornoch firth on its northern side, and Loch an Lagain flows by a longer stream (the river Evelix) also into the Dornoch firth on its northern side. Loch Buidhe flows by the river Torboll into the river Fleet at the head of Loch Fleet. The boundary-line between Ross-shire and Sutherlandshire follows the course of the river Oykell from the head of the Dornoch firth to Breabag Tarsuinn, passing up the middle of Loch Ailsh, which thus lies partly in Ross and partly in Sutherland, while Lochs Craggie and an Daimh are located in Ross-shire and the remaining lochs under consideration in Sutherlandshire.

Loch Shin (see Plates I. and II.).—Loch Shin is the largest loch in Scotland to the north of Loch Ness, and as regards length it ranks fifth of all Scottish lochs, being exceeded in this respect only by Lochs Awe, Ness, Lomond, and Shiel. It is a fine sheet of water situated amid beautiful scenery, with Ben More Assynt and Coniveall rising to heights exceeding 3200 feet on the west, and Meall an Eoin (3154 feet) on the north-east. It is a good trout loch, containing also *Salmo ferox*, and the islands are much frequented by wildfowl. It trends in a north-west and south-east direction, and the length measured along the centre of the loch is about $17\frac{1}{4}$ miles. The loch is on the whole very narrow, the maximum breadth exceeding 1 mile at the junction with the small arm leading to Loch a' Bhainbh, and also at the position of the delta formation at the mouth of the river Fiodhaig. Elsewhere the breadth is considerably less than a mile, and the upper portion, to the north-west of the entrance of the river Fiodhaig, is all less than half a mile in width. The mean breadth of the entire loch is half a mile, or only 3 per cent. of the length—a percentage smaller than has been observed in any other loch except Loch Shiel.* The waters of Loch Shin cover an area of about 5570 acres, or nearly $8\frac{3}{4}$ square miles, and the area of land draining into it is over 150 square miles, but as it receives the outflow from Lochs Merkland, a' Ghriama, and Fiodhaig, its total drainage area is over 190 square miles—an area twenty-two times greater than that of the loch. Over 800 soundings were taken, the maximum depth

* See *Geographical Journal*, vol. 25, p. 270, March, 1905.

recorded being 162 feet, about 7 miles from the foot of the loch, opposite the little Loch an Fhreiceadain on the north-eastern shore. The volume of water contained in the loch is estimated at 12,380 millions of cubic feet, and the mean depth at 51 feet, or 31½ per cent. of the maximum depth. Loch Shin was surveyed on August 25 to September 1, 1902, when the elevation of the lake-surface above the sea was determined by levelling from bench-mark as being 270·85 feet; when levelled by the officers of the Ordnance Survey on August 4, 1870, the elevation was found to be 269·7 feet above sea-level. The farmer at



INDEX MAP OF THE SHIN BASIN.

Overscaig stated that the water might fall 1 foot below, and rise 6 feet above, the level at the time of the survey.

The floor of Loch Shin is very irregular. None of the contour-lines are continuous from end to end of the loch, and the lines themselves are usually of a sinuous character. The 25-feet contour encloses two areas, the 50-feet contour three areas, the 100-feet contour four areas, and the 150-feet contour two areas. The lower 25-feet basin is nearly 10 miles in length, extending from close to the lower end of the loch as far as the alluvial cone at the mouth of the river Fiodhaig. Here for an interval of nearly half a mile the soundings indicate depths less than 20 feet, except for an isolated sounding of 25 feet towards the north-eastern shore. The upper 25-feet basin is nearly 6 miles in length, approaching to within half a mile from the head of the loch. The lower 50-feet basin is about 8 miles in length, extending from within a quarter of a mile from the southern end as far as the entrance of the Allt a' Chairr Bhig. Separated from this lower basin by an interval of more than half a mile there is a second small 50-feet basin based upon soundings of 60, 70, and 80 feet. Proceeding up the loch from this small basin, there is an interval of nearly 3 miles before meeting with the upper 50-feet basin, which is 3½ miles in length, and approaches to within three-quarters of a mile from the head of the loch.

The lower 100-feet basin lies about 2 miles from the foot of the loch, and is about 2 miles in length; the maximum depth recorded in this basin was 140 feet, observed in two different places. Separated from this lower basin by an interval of 1½ miles lies the central 100-feet basin, enclosing the deepest part of the loch, which is about 2 miles in length. The remaining two small 100-feet basins are situated towards the head of the loch, the larger, distant about 1½ miles from the head, being 1 mile in length, and having a maximum depth of 129 feet, separated by an interval of half a mile from the smaller, based upon soundings of 104, 106, and 108 feet. Within the central 100-feet basin above mentioned the bottom sinks in two places below the depth of 150 feet—(1) at the south-eastern end of the 100-feet basin, where soundings of 156 and 157 feet were recorded; and (2) about half a mile farther up the loch and towards the north-eastern shore, where the deepest sounding in the loch (162 feet) was taken—apparently a deep hole surrounded by much shallower water. A section across the loch at the position of the deepest sounding is shown in cross-section E–F on Plate II., and similar sections are shown in cross-section C–D on Plate I. taken towards the head of the loch, and in cross-section G–H on Plate II. taken towards the foot of the loch. In these three sections the deepest part of the loch is seen to lie nearer to the north-eastern than to the south-western shore, but this disposition does not hold good throughout the loch, for in some of the other lines of soundings the deepest casts were taken towards the south-western shore. The longitudinal section A–B, placed at the foot of the two maps, taken along the axis of maximum depth from end to end of the loch, shows how irregular the lake-floor is along this central line, and many of the lines of soundings indicate undulations more or less pronounced, some of which give rise to striking sinuosities in the contour-lines, while others do not affect the contours, or only slightly, and are therefore not so easily remarked. As a rule, shallow water is found offshore, but occasionally deep soundings were taken close inshore—for instance, off the small promontory on the north-eastern shore, $1\frac{1}{4}$ miles from the head of the loch, a sounding of 36 feet was recorded; farther down the same shore, off the mouth of the an Garbh-allt, a sounding of 57 feet was taken; near the pier at Shiness quarry on the same shore depths of 32 and 40 feet were found; and along the opposite shore towards the foot of the loch depths of 32, 36, 37, and 38 feet were found here and there inshore.

The alluvial cone at the mouth of the river Fiodhaig has already been referred to, and here shallow water extends right across the loch, cutting it into two deeper portions. The land has been cut into a delta-shaped form at the head of the loch, where the river from Loch a' Ghriama flows into Loch Shin.

The areas between the consecutive contour-lines at equal intervals, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 50	3260 ...	58·5
50 „ 100	1480 ...	26·6
100 „ 150	814 ...	14·6
Over 150	14 ...	0·3
	5568	100·0

These figures show that Loch Shin is comparatively shallow, 58 per cent. of the lake-floor being covered by less than 50 feet of water, and 85 per cent. by less than 100 feet of water, while the area deeper than 150 feet is exceedingly small.

Temperature Observations.—Numerous surface temperatures were taken during the week spent on the survey of Loch Shin, the readings ranging from 56°·0 Fahr. to 59°·0 (the air-temperature during the same period ranging from 52°·6 to 63°·0). Three serial temperatures were taken, with the following results:—

Depth in feet.	August 27, 1902, 5.15 p.m	August 30, 1902, 6 p.m.	September 1, 1902, 5.30 p.m.
	° Fahr.	° Fahr.	° Fahr.
0	56·5	56·7	57·0
25	—	56·1	56·8
50	56·0	56·0	56·6
90	—	56·0	—
100	54·2	—	—
150	51·2	—	—

These observations show that the whole body of water down to a depth of 90 feet was practically uniform in temperature, but in the deepest part of the loch a fall of temperature amounting to 3° was observed between 100 and 150 feet. The extreme range of temperature from surface to bottom and from end to end of the loch amounted to only 7°·8.

Loch Merkland (see Plate III.).—Loch Merkland lies about 3 miles to the north of the head of Loch Shin, amid beautiful surroundings, Ben Hee rising to a height of 2864 feet on the north-east, with Carn Dearg (2613 feet) and other heights to the north, and Ben Leoid (2579 feet) to the west. It trends in a north-north-west and south-south-east direction, and is 3 miles in length, with a maximum breadth of over one-third of a mile, the mean breadth being a quarter of a mile. Its waters cover an area of about 440 acres, or two-thirds of a square mile, and it drains an area of about 16 square miles. Nearly one hundred and twenty soundings were taken, the maximum depth of 85 feet having been observed close to the narrows towards the head of the loch. The volume of water is estimated at 577 million cubic feet, and the mean depth at over 30 feet. The loch was surveyed on September 2, 1902, when the elevation of the lake-surface above the sea was found to be 360·2 feet.

Loch Merkland is comparatively simple in conformation; the deeper water occurs towards the head of the loch, and is cut into two portions by a shoaling of the bottom at the narrow portion where the large alluvial cone laid down at the mouth of the Allt nan Allbannach on the north-eastern shore approaches the smaller cone at the mouth of the Garbh Allt on the opposite shore. The depth of the channel at the narrows referred to is 31 feet, and the 10-feet and 25-feet basins extend from end to end, roughly approximating with the outline of the loch. The principal 50-feet basin extends from the narrows for a distance of three-quarters of a mile down the loch, and there is an isolated sounding of 52 feet to the north-west of the narrows. The 75-feet basin is a long and narrow area, half a mile in length, the deepest sounding having been recorded at the upper end of this basin, and comparatively close to the south-western shore, off which the slope is steep. This is well shown in the cross-section E–F on the map, and at other places along both shores the soundings indicate steep slopes. The longitudinal section A–B shows the shoaling of the water at the narrows, deepening immediately to the south-east to the maximum depth of the loch ; there is also a scarcely perceptible shoaling farther down the loch, where a sounding of 37 feet was recorded, with 47 feet to the north-west, and 41 feet to the south-east. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows :—

Feet.		Acres.		Per cent.
0 to 25	... ...	190	...	43
25 „ 50	... ...	198	...	45
50 „ 75	... ...	37	...	9
Over 75	... ...	14	...	3
		439		100

These figures show that the average slope is slightly steeper within the 25-feet line than between 25 and 50 feet, and they also show how circumscribed is the area deeper than 50 feet, 88 per cent. of the lake-floor being covered with less than 50 feet of water.

Temperature Observations.—A series of temperatures taken in the deepest part of the loch at 6 p.m. on the date of the survey gave the following results :—

Surface	56°·8 Fahr.
25 feet	56°·2 "
50 "	56°·0 "
80 "	55°·8 "

These observations indicate a range of only 1° from surface to bottom.

Loch a' Ghriama (see Plate III.).—Loch a' Ghriama (or Griam) lies immediately to the north of the head of Loch Shin, into which its waters are carried by a short rapid stream. The distance between the two lochs is only a quarter of a mile, and at the time of the survey there was a difference in level of nearly 33 feet. It is a good trout loch, and *Salmo ferox* is also found in it. The principal feeder is the Amhainn an Ceardaich, over a mile in length, bearing the outflow from Loch Merkland. It trends almost north and south, and is $1\frac{1}{2}$ miles in length, nearly uniform in width, the maximum breadth being over a third of a mile, and the mean breadth over a quarter of a mile. Its waters cover an area of about 260 acres, and it drains directly an area of over $6\frac{1}{2}$ square miles; but since it receives the outflow from Loch Merkland, its total drainage area is over $22\frac{1}{2}$ square miles—an area fifty-seven times greater than that of the loch. The maximum depth of 64 feet was observed approximately in the centre of the loch, but rather nearer the northern than the southern end. The volume of water is estimated at 314 million cubic feet, and the mean depth at 28 feet. The loch was surveyed on September 1, 1902, when the elevation of the lake-surface above the sea was found to be 303·7 feet, which is almost identical with the elevation observed by the Ordnance Survey officers on July 4, 1856, viz. 303·5 feet.

The conformation of Loch a' Ghriama is simple, with one or two very slight undulations of the lake-floor, the principal of which gives rise to a striking sinuosity in the 50-feet contour; otherwise the contour-lines coincide approximately with the outline of the loch. The 25-feet basin is about $1\frac{1}{4}$ miles, and the 50-feet basin over half a mile, in length. The longitudinal section C–D, and the cross-section G–H taken at the position of the deepest sounding, show generally a gradual slope down to the greatest depth, and this is borne out by the following table, giving the areas between the contour-lines and the percentages to the total area of the loch :—

Feet.	Acres.	Per cent.
0 to 25	121	47
25 „ 50	106	41
Over 50	30	12
	257	100

Temperature Observations.—The following series of temperatures, taken at 3 p.m. on September 1, 1902, in the deepest part of Loch a' Ghriama, indicates a range of only 2° from surface to bottom:—

Surface	57°·0 Fahr.
25 feet	56°·2 „
55 „	55°·0 „

Loch Fiodhaig (see Plate IV.).—Loch Fiodhaig (or Fiodiag or Fiag) lies to the north-east of the head of Loch Shin, into which its superfluent waters are carried by the river Fiodhaig (or Fiag). This is a good trout loch, but the fishing is preserved, surrounded by moorland hills, with Ben Hee rising to the north. It receives the outflow from Loch a' Ghorm-Choire and another smaller loch lying to the north, which were not sounded. The loch trends in a north and south direction, and is over $1\frac{1}{2}$ miles in length, with a maximum breadth near the northern end of two-thirds of a mile. Its waters cover an area of about 370 acres, or over half a square mile, and an area twenty times greater—an area of over $11\frac{1}{2}$ square miles—drains into it. The maximum depth of 71 feet was observed not far from the largest island in the loch, and nearer the northern than the southern end. The volume of water is estimated at 415 million cubic feet, and the mean depth at nearly 26 feet. Loch Fiodhaig was surveyed on October 23, 1902, but the elevation above the sea was not determined by levelling; judging from the contour-lines, the lake-surface is apparently nearly 700 feet above sea-level. The loch is irregular both in outline and conformation. The lake-floor shows undulations, and in some places deep water approaches very close to the shore, as may be seen in the two sections on the map. The areas between the contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25	203	55
25 „ 50	133	36
Over 50	33	9
	369	100

The temperature of the surface water on the date of the survey was 48°·0 Fahr. (the air-temperature being 51°).

Gorm Loch Mòr (see Plate V.).—Gorm Loch Mòr lies about 4 miles to the west of the head of Loch Shin, in a mountainous district, with

Beinn Leoid (2597 feet) to the north, Beinn Uidhe (2384 feet) to the west, and Ben More Assynt (3273 feet) and Coniveall (3234 feet) to the south. Its outflow is carried through a series of smaller lochs (Fionn Loch Mòr, Fionn Loch Beag, and Loch na Sròine Luime), which could not be sounded, into the river Cassley. Though a comparatively small loch, it has the distinction of being deeper than the other lochs in the basin, except Loch Shin. It is very irregular in outline, and includes many islands. The length of the loch, along a straight line from north-west to south-east, is slightly over a mile; but along a line following the deeper water it is considerably more. The greatest width in a north-and-south direction is over half a mile, the mean breadth of the entire loch being less than a quarter of a mile. Its waters cover an area of about 185 acres, or over a quarter of a square mile, and it drains an area of 5¼ square miles. Nearly seventy soundings were taken, the maximum depth of 91 feet being observed comparatively close to the western shore. The volume of water is estimated at 196 million cubic feet, and the mean depth at over 24 feet. The loch was surveyed on October 22, 1902, when the elevation of the lake-surface was found to be 837 feet above the sea; when visited by the Ordnance Survey officers on October 1, 1870, the elevation was 846·4 feet above sea-level.

The floor of Gorm Loch Mòr is most irregular, islands and banks and deep soundings being found here and there in close proximity, while in other places deep water approaches close to the shore. The contour-lines are of the most sinuous description, with isolated deep and shallow patches. The deepest part of the loch runs along the western shore, off which the slope is uniformly rather steep, and occurs towards the north-western end, as will be seen in the longitudinal section A–B on the map. The areas between the contour-lines, and the percentages to the total area of the loch, are as follows :—

Feet.	Acres.	Per cent.
0 to 25	126	68
25 „ 50	35	19
50 „ 75	16	8
Over 75	8	5
	185	100

Temperature Observations.—A surface reading at 10 a.m. on October 22, 1902, when commencing the survey, gave 44° Fahr., but at 2 p.m. in the deepest part of the loch a series of temperatures gave identical readings, viz. 46°·2, at the surface, and at 10, 25, 50, and 75 feet.

Loch Ailsh (see Plate V.).—Loch Ailsh lies about 10 miles to the west of Loch Shin, with the heights of Ben More Assynt and Coniveall rising to the north. It is a moderate-sized but rather shallow loch, containing trout and an occasional salmon or grilse. It is irregular in outline, slightly under a mile in length from north to south, with a maximum width in the northern portion exceeding half a mile. Its waters cover an area of about 245 acres, and it drains an area forty-four times greater—an area of nearly 17 square miles. The maximum depth of 24 feet was observed in the north-eastern part of the loch, less than a quarter of a mile from the alluvial cone laid down at the mouth of the river Oykell on the northern shore. The volume of water is estimated at 88 million cubic feet, and the mean depth at $8\frac{1}{3}$ feet. The loch was surveyed on September 6, 1902, when the elevation of the lake-surface above the sea was found to be 498·5 feet, almost identical with that observed by the Ordnance Survey officers on August 29, 1871, viz. 498·4 feet. The highest drift-mark observed was 4 feet above the level of the water on the date of the survey. The southern and western portions of Loch Ailsh are covered by less than 10 feet of water, the deeper part lying along the eastern shore and towards the north-eastern angle of the loch. The area of the lake-floor covered by less than 10 feet of water is about 173 acres, or 71 per cent. of the entire area, while that covered by more than 20 feet of water is only about 12 acres, or 5 per cent. The temperature of the surface water at 2 p.m. on the date of the survey was 55°·3 Fahr., and a reading at a depth of 20 feet gave 54°.

Loch Craggie (see Plate V.).—Loch Craggie is a small but rather deep loch, less than 3 miles to the south of Loch Ailsh, the road from Oykell Bridge to Lochinver running along the northern shore. It trends in a north-west and south-east direction, is nearly two-thirds of a mile in length, and covers an area of about 45 acres. The maximum depth of 40 feet was observed approximately in the centre of the loch. The volume of water is estimated at 30 million cubic feet, and the mean depth at $15\frac{1}{3}$ feet. It was surveyed on September 23, 1902, when the elevation of the lake-surface was found to be 505·95 feet above the sea; when visited by the Ordnance Survey officers on August 26, 1871, the elevation was 506·5 feet above sea-level.

Loch Craggie is quite simple in conformation. The water is deep close to the shore all round, except towards the outflow at the south-east end, the area of the lake-floor covered by less than 10 feet of water being only about 15 acres, or 34 per cent. of the entire area; more than half of the bottom is covered by water between 10 and 25 feet in depth, while about 6 acres, or 13 per cent., are covered by more than 25 feet of water. Temperature observations taken at 3.30 p.m. on the date of the survey showed that the water was practically uniform in temperature from surface to bottom, the reading at the surface being 52°·8 Fahr., and at the depths of 15 and 30 feet, 52°·5.

Loch an Daimh (see Plate V.).—Loch an Daimh (or Damph) is situated about 7 miles to the south-west of Oykell Bridge, and about 8 miles to the east of Ullapool on Loch Broom. Though at present in the eastern watershed, the day may not be far distant when it will be diverted to the west, for the small stream flowing into tho Rhidorroch river is cutting back rapidly, is much lower than the loch, and will probably tap the loch at its south-west end. The shores rise well above the loch, and the south-eastern shore is wooded; it is a good trout loch, but the fishing is preserved. Loch an Daimh is a narrow loch trending south-west and north-east, nearly 1¾ miles in length, with a maximum breadth of only one-fifth of a mile. Its waters cover an area of about 173 acres, or a quarter of a square mile, and it drains an area of about 2½ square miles. The maximum depth of 52 feet was observed approximately near the centre of the loch, but towards the south-west end. The volume of water is estimated at 205 million cubic feet, and the mean depth at over 27 feet. The loch was surveyed on August 23 and 25, 1902, when the elevation of the lake-surface was found to be 671·5 feet above the sea—identical with the elevation observed by the Ordnance Survey officers on August 1, 1870; during the winter of 1901–2 the water rose 2 to 3 feet.

Loch an Daimh is extremely simple in conformation, with no pronounced irregularities of the lake-floor. The 10-feet and 25-feet basins extend from end to end, and the 50-feet basin, half a mile in length, occupies a central position. The off-shore slope is in some places very steep, and the average slope outside the 25-feet contour is steeper than in the deeper water between 25 and 50 feet, as shown in the following table giving the areas between the contour-lines, and the percentages to the total area of the loch:—

Feet.	Acres.	Per cent.
0 to 25	77	44·5
25 „ 50	87	50·6
Over 50	9	4·9
	173	100·0

The surface temperature on August 23, 1902, at 12.30 p.m., was 57° Fahr.; and on August 25, at 11.45 a.m., 56°.

Loch Migdale (see Plate VI.).—Loch Migdale is situated close to the northern shore of the Dornoch firth, and less than a mile from Bonar Bridge at the head of that firth. It contains trout and pike, and the surrounding scenery is very fine, a conspicuous hill called Migdale Rock, rising off the north-eastern shore. The island at the west end of the loch is artificial, composed of large and small stones; a crossing passes from the western shore to the island, and was covered by a foot of water at the time of the survey. The loch trends in a north-west and south-east direction, and is nearly 2 miles in length, with a maximum width of nearly half a mile towards the north-west end, the loch narrowing gradually towards the opposite end. Its waters cover an area of about 260 acres, and it drains an area of about $7\frac{1}{4}$ square miles. The maximum depth of 49 feet was observed rather nearer the north-west than the south-east end. The volume of water is estimated at 242 million cubic feet, and the mean depth at over 21 feet. Loch Migdale was surveyed on September 24, 1902, when the elevation of the lake-surface was found to be 113·6 feet above the sea; when visited by the Ordnance Survey officers on November 1, 1869, the elevation was 115·1 feet above sea-level.

The loch forms a simple basin, with a few minor undulations of the lake-floor. The contour-lines approach nearer to the eastern end, where the Spinningdale burn flows out, the water being shallower towards the opposite end, with weeds growing off the northern shore, at the entrances of Migdale burn and Munroe's burn. The area of the lake-floor covered by less than 10 feet of water is about 70 acres, or 27 per cent. of the total area, while that covered by more than 25 feet of water is about 94 acres, or 36 per cent. Temperatures taken at 6 p.m. on the date of the survey, in the deepest part of the loch, showed very little variation in the temperature of the water, the reading at the surface being 54°·9 Fahr., at 25 feet 54°·1, and at 40 feet 54°.

Loch an Lagain (see Plate VI.).—Loch an Lagain (or Laggan) lies about $3\frac{1}{2}$ miles to the north-east of Bonar Bridge. It receives the outflow from Loch Laro (which was not sounded), and its superfluent waters are carried by the river Evelix, after a long winding course, into the Dornoch firth. It is a small, comparatively shallow loch, trending almost east and west, one mile in length, with a maximum width towards the western end of nearly a quarter of a mile, narrowing gradually towards the eastern end. Its waters cover an area of about 68 acres, and it drains a relatively large tract of country, the area of which exceeds 8 square miles—an area seventy-four times greater than that of the loch. The maximum depth of 18 feet was observed near the centre of the loch, but towards the northern shore. The volume of water is estimated at 23 million cubic feet, and the mean depth at $7\frac{1}{2}$ feet. The loch was surveyed on September 25, 1902, but the elevation of the lake-surface above the sea could not be determined; the Ordnance Survey officers levelled the loch on November 23, 1869, and found the elevation to be 446·2 feet above sea-level. The lake-floor is quite simple in conformation, with no irregularities, the deeper water approaching nearer to the eastern than to the western end; the area covered by less than 10 feet of water is about 49 acres, or 71 per cent. of the total area of the loch. The temperature of the surface water was 53°·0 Fahr., and a reading at a depth of 9 feet gave 52°·9.

Loch Buidhe (see Plate VI.).—Loch Buidhe (or Buie) lies amid moorland hills about 5 miles to the north-east of Bonar Bridge, the road from that place to Golspie running along its southern shore. It receives the outflow from Lochs Cracail Mor and Cracail Beag (which were not sounded), and flows, as already stated, into the head of Loch Fleet. It is a good trout loch, but an attempt to introduce salmon failed. The loch trends east and west, and is $1\frac{1}{4}$ miles in length, with a maximum breadth of nearly a quarter of a mile. Its waters cover an area of about 133 acres, and it drains an area of about $8\frac{3}{4}$ square miles—an area over forty times greater than that of the loch. The maximum depth of 36 feet was observed approximately in the centre of the loch. The volume of water is estimated at 68 million cubic feet, and the mean depth at $11\frac{3}{4}$ feet. The loch was surveyed on September 25, 1902, when the elevation of the lake-surface above the sea was found to be 528·45 feet; when visited by the officers of the Ordnance Survey on May 21, 1870, the elevation was 527·3 feet above sea-level. By means of the sluice at the east end of the loch the level of the water may be raised 4 or 5 feet, but it is seldom, or never, used; according to the keeper, the water may fall 2 feet below the level on the date of the survey.

Loch Buidhe is quite simple in conformation, the bottom sinking gradually on all sides from the shore to the deepest part, which occupies a central position. The area of the lake-floor covered by less than 10 feet of water is about 66 acres, or 50 per cent. of the total area of the loch, while that covered by more than 25 feet of water is about 4 acres, or 3 per cent. Temperature observations taken in the deepest part of the loch at 1.30 p.m. on the date of the survey showed little variation, the reading at the surface being 52°·6 Fahr., at 20 feet 52°·1, and at 30 feet 52°·0.

The particulars regarding the lochs dealt with in this paper are collected together in the following table for convenience of reference and comparison.

From this table it will be seen that in the eleven lochs under consideration, which cover an area of over 12 square miles, nearly 1600 soundings were taken, or an average of 129 soundings per square mile of surface. The aggregate volume of water contained in the lochs is estimated at 14,500 millions of cubic feet, and the area draining into them is nearly 240 square miles, or twenty times the area of the lochs.

SUMMARY TABLE.

Giving Details concerning the Lochs described in this Paper.

Loch.	Height above sea. Feet.	Number of soundings.	Length in miles.	Breadth in miles.		Mean breadth per cent. of length.	Depth.			Ratio of depth to length.		Volume in million cubic feet.	Area in square miles.	Drainage area.	
				Max.	Mean.		Max. Feet.	Mean Feet.	Mean per cent. of max.	Max.	Mean.			Total in square miles.	Ratio to area of loch.
Shin	270·85	815	17·22	1·12	0·51	3·0	162	51·0	31·5	561	1781	12,380	8·70	190·29	21·9
Merkland	360·2	115	3·02	0·37	0·23	7·6	85	30·1	35·5	188	529	577	0·69	15·94	23·1
a' Ghriama	303 7	80	1·50	0·37	0·27	18·0	64	28·0	43·8	124	283	814	0·40	22·60	56·5
Fiodhaig	—	47	1 61	0·68	0·36	22·4	71	25·8	36·3	120	330	415	0·58	11·66	20·1
Gorm Loch Mòr ...	847·0	68	1·39	0·52	0·21	15·1	91	24·3	26·7	81	302	196	0·29	5·21	18·0
Ailsh	498·5	89	0·95	0·58	0·40	42·1	24	8·3	34·6	209	604	88	0·38	16·83	44·3
Craggie	505·95	41	0·62	0·18	0·11	17·7	40	15·3	38·3	82	214	30	0·07	0·87	12·4
an Daimh	671 5	65	1·71	0·20	0·16	9·4	52	27·2	52·3	174	332	205	0·27	2·44	9·0
Migdale	113 6	104	1·92	0·41	0·21	10·9	49	21·2	43·2	207	479	242	0·41	7·21	17·6
an Lagain	446·2 [23/11/69]	60	1·00	0·23	0·11	11·0	18	7·6	42·1	293	697	23	0·11	8·14	74·0
Buidhe	528·45	80	1·27	0·22	0·16	12·0	36	11·7	32·6	186	572	68	0·21	8·70	41·4
		1564										14,538	12·11	239 69 *	19·8

* The drainage areas of Lochs Merkland, a' Ghriama, and Fiodhaig are included in that of Loch Shin.

NOTES ON THE GEOLOGY OF THE SHIN BASIN.

By B. N. PEACH, LL.D., F.R.S., and J. HORNE, LL.D., F.R.S.

Of the area included in the basin of the Shin, only narrow belts along the west, north, and east margins have been mapped by the Geological Survey. The greater part of the tract is occupied by crystalline schists of the types so largely developed in the counties of Sutherland and Ross, to the east of the line of complication which stretches southwards from Loch Eireboll by the headwaters of the Cassley and the Oykell rivers to Ullapool. The course of the Moine thrust—the most easterly of the great Post-Cambrian displacements described in the "Notes on the Geology of the Assynt District," * runs south from Gorm Loch Mòr by Loch Ailsh to near Loch Craggie, thence it curves westwards to Knockan beyond the limits of the Shin basin. East of this dislocation, the metamorphic rocks include quartz schists, quartz-biotite-granulites, garnetiferous muscovite-biotite schists and flaggy micaceous gneisses. These are pierced by igneous materials (granite and diorite) that cover considerable areas, as near Lairg.

Along the eastern part of the basin there is a belt of Old Red Sandstone strata running in a north-east and south-west direction, its western limit being approximately defined by a line drawn from the Mound station to a point west of Edderton station. Both the middle or Orcadian and the upper divisions of this formation are represented, the latter occurring between Tain and Tarbat Ness and northwards along the shore by Dornoch.

Gorm Loch Mòr.—This lake, situated in the high plateau east of Ben More, lies in a rock basin formed mainly of Cambrian quartzite. Part of the floor, where the Garbh Allt enters the loch, may be composed of thrust Lewisian gneiss underlying these quartzites. The deepest sounding is 91 feet, and at the outlet the water flows over ledges of the higher or "pipe-rock" zone of the quartzite. Around the lake, the traces of glaciation are extremely abundant. Both the striæ and the disposition of the carried boulders prove that, during the greatest extension of the later glaciers, the ice radiating from the east side of the Ben More range crossed the ridge in a north-east direction beyond Gorm Loch Mòr and overflowed into Loch Shin. At a later stage, the glacier that issued from Coire a' Mhadaidh curved round Cailleach an t-Suiomha on the west side of Gorm Loch Mòr, and moved north-west by Glen Beg to the head of Loch Glencoul. The quartzite plateau in the east part of the lake is dotted over with moraines, which there form the islands.

Loch Ailsh is a shallow lake—the greatest depth being 24 feet—partly enveloped in drift and solid rock. It rests on various zones of Cambrian age, including the quartzite, Fucoid beds, serpulite grit, and limestone with intrusive igneous materials, all overlying the Ben More thrust-plane. From the covering of drift, it is uncertain whether this lake is a true rock basin. Its surface level is 498·5 feet, and the rock first appears at the outlet at a height of 490 feet above Ordnance datum line.

Loch Craggie is a true rock basin, the deepest sounding being 40 feet. The rocky barrier is formed by siliceous schists and mica-schists that are well exposed in the stream below the outlet and by the side of the road along the north bank of the lake. The height of the surface of the water above sea-level is 505·95 feet, and that of the solid rock where the bridge spans the Craggie burn below the outlet is 505 feet. The direction of the ice-movement during the later glaciation was parallel with the long axis of the lake.

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* See *Geogr. Journ.*, vol. 23, p. 461, April, 1904.

Loch an Daimh lies along a line of dislocation or fault that has been traced for a long distance in the crystalline schists south-westwards towards the head of Loch Broom. In the streams draining the hill slope on the northmost side the strata are exposed, which there consist of quartzose granulites with intercalations of mica-schist. On the higher part of the declivity the beds dip at gentle angles to the south-east, but on approaching the lake they are thrown into rapid folds parallel with its long axis, and are much crushed and shattered. At its lower end the lake is invaded by cones of alluvium brought down by the streams on either side.

NOTES ON THE BIOLOGY OF THE LOCHS OF THE SHIN BASIN.

By JAMES MURRAY.

COLLECTIONS of plankton were made in eight lochs of the basin. The lochs are mainly characterized by the presence of two northern species of *Diaptomus* (*D. laciniatus* and *D. laticeps*), besides the common *D. gracilis*, and by the very numerous Desmids, many of which are of the western type.

Each of the three species of *Diaptomus* was found in five lochs—*D. gracilis* in Lochs Shin, a' Ghriama, Ailsh, Gorm Loch Mòr, and Fiodhaig; *D. laciniatus* in Lochs Shin, a' Ghriama, Merkland, Ailsh, and an Daimh; *D. laticeps* (or a related species) in Lochs a' Ghriama, Ailsh, an Daimh, Gorm Loch Mòr, and Fiodhaig. All three species occurred together only in two lochs, a' Ghriama and Ailsh, while in all the other lochs, except Merkland and an Lagain, there were two species; in Loch Merkland *D. laciniatus* was the only species seen. *D. laticeps* was identified in Lochs a' Ghriama and Ailsh; in Lochs an Daimh, Gorm Loch Mòr, and Fiodhaig, a species of the same group occurred, but as only females or immature males were seen, it is not certain whether they were *D. laticeps* or the very closely related *D. wierzejskii*.

Among other Crustacea there is little to note—*Holopedium* was only seen in Lochs Shin and a' Ghriama; *Leptodora* in Lochs Shin, a' Ghriama, and an Daimh; *Sida* in Loch a' Ghriama only; *Diaphanosoma* in nearly all of the lochs. Nearly all the *Daphniæ* of Loch Fiodhaig were males.

Ilyocryptus acutifrons, G. O. Sars, was found in Loch Shin in August, 1903, being previously unrecorded for Great Britain. It was obtained in a shallow bay at the mouth of the Fiodhaig river.

The Desmids of Loch Shin have been fully studied by Messrs. W. and G. S. West.* On the occasion of our visit the very great abundance, of individuals as well as species, was remarkable, exceeding anything that we had observed in other lochs. In Lochs a' Ghriama and Merkland the species were also very numerous, and on the whole the same as in Loch Shin. In Lochs Ailsh, an Daimh, and an Lagain, few Desmids were seen, but all had some of the western species. In Gorm Loch Mòr and Loch Fiodhaig no Desmids were noted.

Pelagic Rotifera were abundant only in Lochs Shin, a' Ghriama, and Ailsh; in Loch Shin the plankton collections also included many littoral species, which must have been driven out by the stormy weather. *Floscularia pelagica*, Rousselet, was in Loch a' Ghriama only. Skeletons of the Heliozoan, *Clathrulina elegans*, were abundant in Lochs Shin and a' Ghriama.

* See *Journ. Linn. Soc., Bot.*, vol. 35, p. 519, 1903.

THE ALEXANDER-GOSLING EXPEDITION IN THE SUDAN.

THE following communication has been received from Lieut. Boyd Alexander, dated "River Shari, May 26, 1905:"—

The expedition has received a rather serious check as regards its forward movement, owing to the difficult navigation of lake Chad. Having got together a sufficient number of bullocks to carry the heavy loads by land to Kusseri, I left our camp at Kadde, close to the lake, with Gosling on February 12. A few days later I left with my collector Lopes in the two boats to find a waterway from Kadde to Kusseri. I reached the Yo mouth on February 27. The river was still running, but had fallen considerably, and in places it was fordable. My journey thus far buoyed me up considerably, as I found open water with an average depth of 3 feet. From the mouth I struck in an easterly direction, and all went well for two days, during which I covered approximately 20 miles. But on the third day trouble commenced. I could not find more than a foot of water—covering unfathomable thick black mud. I could find no open water, nothing but a mass of small islands, which formed innumerable shallow bays. These islands are not of large extent; their average length does not exceed a mile. They are low, of a sandy soil, and covered with scrubby bush-growth and reed, not a few being fishing-stations where the Budumma dry their fish. On the larger ones there are cattle stations, which consist of reed-built huts of Kaffir-kraal shape, very small in circumference, and not more than 4 feet high.

It was most disheartening work—finding sufficient water for the boats one day, only to discover the next morning that it had left one nearly high and dry in the mud. This generally occurred after a strong wind from the north-east, but not always so. At night the water, independently of any wind, used frequently to fall as much as 6 inches; and then towards mid-day it would commence to flow again, and be at its full about three o'clock. On several occasions I found traces of currents running in a south-easterly direction, at the rate of a mile an hour.

In my struggle to get across the lake, one of the worst things I had to face was the mosquitoes, which swarmed in clouds, making it a perfect hell upon earth. On March 20 I returned to Kadde, and made preparations for a second attempt in a due easterly direction from this place. But, to cut a long story short, I met with the same ill success—no water after 25 miles, only groups of small islands, behind which was a long tract of land running in a north-westerly direction, and which I was unable to skirt. This, I fully believe now, forms the east coast of the lake. This land to the south bends round in a semicircle to within 5 miles of Kadde, when dense masses of reeds connect it with the mainland. I have now no doubt whatever, and the Budumma tell me the same thing, that this land divides the lake in two, and there is no water-communication between the two sides.*

I made an attempt to cut my way through the reeds I have just spoken of, but the growth was so dense that I had to give it up and return again to Kadde, where no other course was left to me but to take the boat to pieces and carry them 30 miles to a Budumma fishing-station close to the lake, where I learnt that the water was more open. What with sickness and desertion, I found myself left with only seven men, and it was a good month before I could get everything up to the fishing-station and the boats put together again.

The Budumma call this place Seyurum, which they say was once an island, but is now part of the mainland. On reconnoitring the water near this place, I found that this seemingly open water, averaging a depth of 4 feet, was nothing more than a large bay, enclosed on every side by great belts of reeds, 5 to 6 feet high, and clumps of maria bush, growing out of water 2 to 3 feet deep. There was nothing for it but to cut a road for the boats. A day's cutting through the reeds in a north-easterly direction brought me out again into another large bay of the same aspect as the first. The next cutting was still more serious, and took me two days; but after that I found pretty deep water, averaging a depth of 5 feet. There is now a clear road between our side and Kanem, with water sufficient for a launch drawing 2 feet.

Up to this time the Budumma had held severely aloof, but now a kachella, or chief, of a large fishing fleet we met, came forward and offered to show us the road to Bol, a French station on the Kanem coast. After getting out of the thick reed-belts the aspect of the lake presented quite a different look from that of the Yo side. The small low flat islands of the latter gave way to big island stretches, with channels sometimes not more than 100 yards wide, at other times forming bays as much as 2 miles in width, lined with belts of dark-green maria 10 to 30 feet in height, and relieved by the reddish-brown feathery branches of a thornless acacia. A day from the reeds brought us to Karraragga, the island of the kachella, who took us to his town, a rather pleasing event after having struggled for nearly two months to get a glimpse of one. This island presented a very fertile appearance—most refreshing to the eye after the sand-swept stretches of Bornu.

This kachella's town consisted of reed-built huts, conical in shape right down to the ground. Each hut had its low round mosquito house, covered with close-woven matting. The Budumma all speak Kanuri or Beri-Beri. They come very close to the Kanembu, with whom they intermarry. They are tall men, with well-developed heads and foreheads,

* This seems to imply that the lake has fallen still further since Captain Lenfant's expedition navigated it. That officer's map (*La Géogr.*, June, 1904) shows a strip of navigable water running quite down the west coast and across towards the Shari mouth.

but blunt noses, and, living as they do on fish, their skins are very sleek and oily. As to dress, the men wear the loose-fitting dark-blue toga of native cloth, common in Bornu, which they get in return for their fish in the Koa market. The women are small, and in their headdress resemble the Kanembu.

The Budumma are not a fighting race; they are timid, and certainly a good deal of my trouble has been in trying to make friends with them. They drive their canoes along at a prodigious rate, youths and small boys doing all the work of poling. Their canoes—made of bundles of dried reeds tied together and turned up at the prow—are most picturesque, especially when one sees a number together, which is generally the case, the people visiting their fishing-grounds in large fleets of from twenty to thirty boats. The Budumma catch the majority of their fish in nets, but the larger ones of 3 feet and upwards in length are speared. Most of the fish are dried and taken to the Bornu markets.

The Budumma on the Shari side are a much more enlightened lot of people than those on the Yo-Chad water, whom the former despise, and who are a bush people, coming, from what I can make out, from a country called Kologo, in the north-east of Kanem. They are nothing more than robbers and slave-dealers, and the sooner they are taken in hand, the better it will be for our rule in Bornu. The eastern Budumma have their chiefs, who are called kachellas, while over all these is the king, who is called the korammi. They are well-to-do people, deriving their wealth from the potash trade and their dried fish. To return to my journey. A distance of 10 miles from Karraragga brought me to a place called Wunda, a Kanembu town on the Kanem coast. It came as a great surprise to me that I was able to reach the other side of the lake in practically two days, and, speaking approximately, the distance is not more than 20 miles, so that a boat can now reach the Kanem side from Koa in a day. Shrinkage of the water must have a great deal to do with it. Many of the islands I passed are now practically one, great belts of reed and grass joining them. At Wunda I found a large amount of potash, which comes a five-days' journey from the Kanem country, and is taken by the Budumma in their canoes to the Bornu markets, where it forms a very lucrative trade, well worthy of protection. Kanem looks a most desolate country, nothing but sand-dunes covered with scrubby acacia growth, whose branches are whitened by the wind-swept sand. All the towns I stopped at were in want of food, and it was with difficulty I could get any for my men. From Wunda I reached Bul, a French station on the Kanem coast, about 8 miles to the south-east.

From this place, after skirting the Kanem coast for a distance of 12 miles, I struck in a westerly direction. This course was difficult, winding through belts of maria that frequently closed together and gave the waterway a width of not more than 100 yards. In these channels I found 9 to 12 feet of water, but soon reed-growth reappeared, and made it necessary to cut a path. At last my Lake Chad troubles ended, for I arrived yesterday at the Shari mouth, after three months' knocking about on the lake. I am sending you from Kusseri, for what it is worth, a map of my first route from the Yo mouth; the others I shall not have time at present to plot. I have made a rather interesting collection of birds on the islands. They differ very considerably from those I collected in Bornu.

From what I have seen of the Shari so far, it is a magnificent little river, but cannot be compared with the Benue in size, the average width being 500 yards; but unlike the Benue, it is quite free of sandbanks. Coming up the river, all the chiefs have shown the greatest hospitality. At present they are between two stools, the Germans on one side and the French on the other. Many of the big chiefs have land and towns on both banks, and the result is a constant source of trouble. Demarcation of territory out here by fixed boundaries, like rivers, seem to me absolutely wrong. Boundaries should be determined by the territories owned by the big chiefs.

Writing from Fort Lamy, June 14, Lieut. Boyd Alexander says—

"I am sending you from here two of my route maps—one from the Yo mouth, the other of the crossing from Seyurum to Bul. According to my course, I cannot make the distance across more than 41 miles, and, approximately, as the crow flies, 30 miles. I have taken all the trouble I could to get the distances as accurately as possible. All the same, my distance across does not tally with that of the present French map which I have seen here, the distance being 60 miles on the latter.* I believe I am the first to cross the lake from our side, so the distance will at present remain *en l'air* till we know the exact positions of Seyurum † and Bul, or rather Munda, which latter place was the first I touched on the Kanem side. The French have just sent up an officer to fix these places and to find my route, with the idea of getting through by it to the Komadugu, but from what I have seen of the lake I think this is impossible. Two years ago the French had a route skirting the Kanem side up to the north end of the lake to their station at Ngegmi, but now there is no water on this road.

"Gosling and I are leaving in the boats to-morrow for the Gribingi, whence we go down the Tomi, and then a porterage of six days will bring us on to the Ubangi. The French have shown us splendid hospitality. Our stores and provisions are lasting out pretty well. We have another six months' supply. We hope to reach the Ubangi by the end of August."

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* Captain Lenfant's map, which Lieut. Alexander had of course had no opportunity of seeing, makes the distance across from the west to the east coast generally under 35 miles, and in one part only about 25 miles.

† The work of the Anglo-French Commission and that of my expedition in Bornu should fix this place.

STATISTICAL ATLAS OF THE UNITED STATES.*

NOTHING is more worthy of commendation than the pains taken by the census department of the United States to present the facts ascertained by the decennial statistical inquiries in the form in which they are likely to be of most use. Statistics are merely raw materials. Their principal use in the great majority of cases is to suggest further inquiry, and this is particularly true of the statistics usually collected at national censuses. That subjects for fruitful investigation may be suggested, it is important that the main facts resulting from the census inquiries should be set forth in such a manner as to catch the attention of the inquirer. Admittedly this is best effected by means of graphic representations, and this is what we have here on a lavish scale. The results of the last census of the United States are here presented on 207 plates each measuring 11½ by 9 inches, and the interest of these plates to the geographer is shown, if by nothing else, by the fact that a large proportion of the graphic representations on these plates are in the form of maps, in many cases six maps on a single plate. The plates are accompanied by a text of 67 pages consecutively numbered from 25 to 91, but interspersed in sections through the volume under different headings, such as population, vital statistics, agriculture, etc. There is also a table of contents and a list of illustrations, occupying together 18 pages.

Different inquirers will look with different degrees of interest on the facts presented by the various plates, and it will therefore be worth while to indicate as fully as possible the contents of the plates, and to draw attention to some of the more striking of their indications.

The first plates are historical, No. 1 showing the successive accretions to the territory of the United States as originally defined by the treaty of 1783, and Nos. 2-12 showing the distribution of population at each of the previous censuses. In these all towns with a population of 8000 and upwards have their position indicated, and it is interesting to notice the first emergence of now populous cities. Cincinnati first appears as a town ("city") with upward of 8000 inhabitants in 1820. Pittsburg and Buffalo have attained that limit by 1830, but St. Louis is still below it. Both St. Louis and Chicago are added to the list in 1840, and Milwaukee appears in 1850. In 1860 St. Paul is indicated as a city above the 8000 limit, but Minneapolis not till 1870, when many other western towns (Des Moines, Council Bluffs, and Omaha; St. Joseph, Leavenworth, Lawrence, and Kansas City; Salt Lake City; San Francisco, Oakland, San Jose, Sacramento, Stockton, Portland, Ore., and others) are also so marked for the first time.

Plate 13 shows the density of population as ascertained by the last census, and plate 14 is a diagram, based on the *Geographisch-Statistische Tabellen* of Juraschek, showing the increase of population of the United States as compared with that of several European countries, to which it would have been interesting to have added another showing the relative rate of increase in the same countries.

Plates 21 and 22 are ingenious coloured diagrams showing the relative ranks of the states and cities respectively at the different censuses. Though rather complicated, they are probably the simplest that could have been devised for the purpose. It may be noted that on the second of these two diagrams there appears the city of Moyamensing in the censuses from 1830 to 1850, at which it held the twenty-eighth place, after which it never reappears. It does not find a place in Colange's *Gazetteer of the United States.*

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* 'Twelfth Census of the United States, taken in the year 1900.' William R. Merriam, Director. Statistical Atlas. Prepared under the supervision of Henry Gannett, Geographer of the Twelfth Census. Washington: 1903.

Plate 25, a map showing the density of increase of population in different parts of the United States between 1890 and 1900, is of peculiar interest. This period was notoriously one of great prosperity for the United States as a whole, prosperity shown by the enormous development of important industries and a very rapid increase in its foreign commerce, and especially in the value of its exports of manufactured goods, a circumstance to which some people attach special importance. Yet it is already a familiar fact that there was a smaller ratio of increase of the population of the country in that than in any previous intercensal period, and this map shows at a glance that there were considerable areas in different parts of the country where there was an absolute decline of population during that period. Most striking of all is the fact that one of the largest of those areas is in the state of New York, extending from the Hudson to the shores of Lake Ontario, and to the vicinity of those of Lake Erie, embracing in all about half the extent of the state, equal to fully three-fourths of the area of Ireland.

Plate 26 is a map showing the proportion of the population in towns of 2000 inhabitants and upwards. That the most extensive area with a large proportion of the population so distributed should be the north-east quadrant (north of 38° N. and east of 97° W.) is only what was to be expected, but the vast extent of the territory in the south-east with no towns above 2000 is very striking, all the more so since this very area is shown by plate 28 to have had in many parts an exceptionally large percental increase of the population.

Plate 42 is made up of a number of circular diagrams proportional in area to the total population at each census, and indicating also the elements of which the population is made up. The earlier diagrams distinguish only the white and coloured population, but the last four distinguish the native whites born of native parents, native whites born of foreign parents, foreign-born whites, and coloured. Neither on the plate nor in the text, however, is it stated to which side those of mixed parentage are referred. From these diagrams it appears that in the last three decades the proportion both of the native whites of native parents and of coloured has been declining, while the other two elements have relatively increased in numbers. In connection with this plate it is of interest to examine plate 87, which contains a diagram in the form of a square of 5 inches, on which the occupations of the people are classified by race and nativity. Agricultural pursuits, professional service, domestic and personal service, trade and transport, and manufacturing and mechanical pursuits are distinguished by five colours, while the four elements of the population enumerated under plate 42 are represented by four horizontal sections proportional to their numbers. If the square had been marked off in hundredths on two sides at right angles to one another, it would have been easier to compare the magnitude of different sections, but even without that aid one cannot fail to notice what a large proportion of the agricultural class is made up of natives born of native parents, and, on the other hand, what a large contingent is furnished to the manufacturing and mechanical section by foreign whites and native whites of foreign parentage. To this section these two elements of the population furnish together a much larger number than that furnished by the other two elements.

Plates 50 and 51 relate to migration and immigration. Plate 50 gives the net results of migration by states and of immigration from abroad and emigration to foreign countries on the population of the different states. As the result of interstate migration only, the states Virginia, Kentucky, Tennessee, North Carolina, Georgia, and South Carolina, showed a loss amounting in each case to upwards of 150,000, while New York, Massachusetts, Illinois, Texas, California, New Jersey, Pennsylvania, and Kansas each gained to the extent of at least half a million. Plate 51, which shows by states the amount of interstate emigration and immigration separately, presents a vivid picture of the present instability of the United States population. In this way New York lost by migration to other states 1,290,000, and gained by entrance from other states about 540,000; Illinois lost 1,013,000 and gained about 960,000; Ohio lost 1,114,000 and gained rather more than 500,000; Missouri lost about 615,000 and gained about 855,000; and Pennsylvania lost about 940,000 and gained about 490,000. This means in the case of Ohio, for example, that, if we take the mean between the population of that state as it was in 1890 and 1900, more than 28 per cent. of the population left the state in that interval, while nearly 13 per cent. were added during the same period.

Plates 53 and 54 relate to the negro population, and Plates 57 to 69 to the foreign-born population. Plate 79 shows the somewhat surprising result that the proportion of illiterates among the native white voters exceeded 10 per cent. in the greater part of the south-east and 25 per cent. in not inconsiderable areas, while plate 80 shows, as was to be expected, a much higher percentage under this head for the negro population, the proportion of illiterates being more than one-half in by far the greater part of the coloured area. Plate 86 shows that in three states, New Mexico, Arizona, and Texas, the number of persons above ten years of age who could not speak English exceeded 25 per cent. of the total population.

Plate 98 is a map showing the average size of families—greatest towards the mouth of the Mississippi valley and in the middle Appalachians (West Virginia), least in the north-east and on the Pacific seaboard—least of all in northern New York and between the south-east of Lake Michigan and Lake St. Clair. Plates 99 and 100, the last under the head of population, show by states—the former the proportion of houses, the latter the proportion of farmhouses owned free, encumbered, and hired in 1900.

Plates 101 to 125 relate to vital statistics, and exhibit, partly on maps and partly by diagrams, the death-rate from various diseases in the registration area for 1900, that is, in the states of New England, in New York, New Jersey, Michigan, and the district of Columbia, together with 153 cities with a population of 8000 and upwards.

Plates 126 to 178 relate to agriculture. The first of these shows the centres of production for maize, wheat, and other products compared with that of manufactures. Plate 129 is a map showing in five tints the average size of farms in different parts of the United States, the lowest tint indicating farms of less than 80 acres on the average, the highest those of more than 640 acres.

Plates 132 to 138 relate to the improvement of land. Plate 132 shows the proportion of improved land to the total area in different parts of the United States, and one of the maps in plate 138 shows the same by states. The greatest proportion of improved land (75 per cent. of the total area and upwards) is found in the north prairie states, from the western frontier of Pennsylvania to eastern Nebraska. Plate 133 shows the difference in farm values at the beginning and end of the five intercensal periods since 1850, and may be compared with advantage, as regards the last period, with plate 25. It shows an increase in farm values in all the states represented between 1850 and 1860. The decline throughout the south-east in the next decade is of course accounted for by the civil war. Between 1870 and 1880 there was a decline in values only in Vermont, New Jersey, and Delaware, but it is noteworthy that between 1880 and 1890 there was an aggregate decline in farm values in all the states from Maine to New Jersey in the east and between the seaboard of those states and Indiana (Indiana not included) in the west, but in no other states, and that between 1890 and 1900 the decline was continued in Maine, New York, Pennsylvania, and Ohio. In that period Florida also showed a decline.

Plate 142 gives a classification of farms by tenure, distinguishing farms cultivated by the owners, farms in the hands of cash tenants, and those in the hands of share tenants. From this diagram it appears that farms cultivated by their owners formed less than half the entire number only in Alabama, Louisiana, Georgia, South Carolina, Mississippi, and the Indian Territory. Only in the Indian Territory did share tenancies exceed one-half the number, and, in addition, only in Texas and Delaware did such tenancies exceed 40 per cent. of the total.

Plates 146 to 149 relate to the rearing of livestock. From these it appears that swine were most numerous (100 or more per square mile) in the greater part of the area between 38° and 43½° N. and 83° and 99° W. (plate 146); neat cattle most numerous (75 and more per square mile) west and south-west of Lake Michigan (plate 147); sheep (50 per square mile and upwards) chiefly in the area between Pennsylvania and the south-east of Lake Michigan (plate 148); while horses, mules, and asses were found to the number of 25 per cent. and over throughout the north-east (plate 149).

Plates 153 to 177 relate to the production of various crops. The aggregate production of all grains per square mile was greatest in Iowa and Illinois (plate 153); that of maize (plate 154) in much the same area as that which reared the largest number of swine; that of wheat (plate 156) greatest south-east of Lake Michigan, in the western prairie states and on parts of the Pacific seaboard, as well as in the north-east of Oregon, and the south-east of Washington, but very scanty (under 64 bushels per square mile) in a very large, almost unbroken area south-west of Lake Michigan, in Illinois, eastern Indiana, and the north-east of Missouri. Oats (plates 158, 159) were very generally and largely cultivated throughout the north-east quadrant of the States except in most of the New England states, and it is noteworthy that they were much grown in the maize area south-west of Lake Michigan, where the cultivation of wheat was very sparse. Rye (plate 160) was grown in three principal areas—(1) north-west of the seaboard stretching from Chesapeake Bay to Long Island sound, (2) on both sides of Lake Michigan, and (3) in eastern Nebraska. The principal barley area (plate 161) was from the middle of Lake Michigan to the west of S. Dakota. Hay and forage crops (plate 162) were plentifully grown throughout the north-east, most abundantly between Lakes Erie and Ontario and the coast.

The cotton area seems scarcely to have passed beyond the limits reached in 1860, although it is difficult to compare the maps compiled at the different dates, as the earlier maps indicated the proportion of the surface occupied by cotton, while one of the two cotton maps (plates 165, 166) for 1900 shows no cotton-growing district where less than one bale per square mile was grown, while the other shows only the yield per acre. The latter shows the most extended area, with an outlying patch in about 38½° N. in Virginia, and another, where it is grown by irrigation, in the adjoining parts of Arizona, Utah, and Nevada; while in the south the continuous cotton area as thus shown extends to the Rio Grande in the south-west, and to Tampa in Florida. The area within which as much as one bale per square mile was grown is very compact, nowhere rising much beyond 37° N., excluding most of Tennessee to the east of the part of the Tennessee river which flows north, so as not to rise in most of that state beyond 35° N., and touching the coast in the east only in North and South Carolina, and in the south only to the south-west of New Orleans and the south-west of Galveston. In the west it extended in one point, about the middle latitude of Texas, beyond 101° W. The more considerable parts of this area yielding above 35 bales to the square mile were four in number—one on both banks of the Mississippi reaching from about the northern limit of the area to near New Orleans; a second curving, with convexity to the south-east, from the angle in the north-west of South Carolina to about the middle of southern Alabama (32° N.); a third, behind the previous, stretching from about the north-east of Georgia south-westwards to about the middle of the eastern frontier of Alabama; and the fourth, in Texas, stretching south from the Red river between 96° and 98° W. It is this last area that shows the greatest advance in productiveness in recent years.

The map showing the production of tobacco per square mile (plate 167) presents a great contrast to that of cotton. The most productive districts, instead of being in a compact area, are scattered over the eastern half of the country, one in the east of North Carolina, a second in the north-west of North Carolina and the adjoining part of Virginia, a third in the south-east of Pennsylvania, a fourth in the south-west of Ohio and eastern Kentucky, a fifth in the south-west of Kentucky and the adjoining part of Tennessee, a sixth in Wisconsin, about 30 to 40 miles to the west of Lake Michigan, crossed by 43° N., and a seventh in the middle of northern Connecticut.

Other maps (plates 173–177) show the production of potatoes and sweet potatoes, apples and pears, cherries, grapes, peaches, apricots, plums, and figs; but it is somewhat surprising and disappointing to find that there is neither map nor diagram to illustrate the distribution of citrus fruits, the vicissitudes of which in past decades are a matter of no little interest in the agriculture of the United States, or that of rice or sugar, whether cane or beet.

Plate 178 furnishes by means of diagrams, but unfortunately no map, a variety of information with regard to irrigation. The greatest extent of irrigation in 1899 was in the state of Colorado, where about 2,000,000 acres, or 3 per cent. of the entire surface, were irrigated, California coming second with less than 2,000,000 acres, and accordingly less than 2 per cent. of the area, which is just under 100,000,000 acres.

	Number of irrigators.	Acres irrigated.
1889	52,584	3,564,416
1899	102,819	7,263,273

The total cost of irrigation in 1899 was about 64,300,000 dollars, the total value of the irrigated crops 84,400,000 dollars.

Plates 179 to 207 relate to manufactures, but some of these it is impossible to interpret with certainty, there being no adequate explanation either on the maps or in the text. On p. 85 there is a reference to p. 37 of the text for a full description of the method of computing the centre of manufactures, but there we find nothing of the sort. All that we do find is an account of the method of computing a centre (of population); but we are told that the centre of manufactures is based on the value of the gross products, and what we want to know is, how this value is determined. From plate 193 we learn that men's and women's clothing was the fifth in the value of its products among the manufacturing industries of the United States in 1900. Now, among these manufactures there must have been large quantities of worsted garments, the production of which involves several successive manufacturing industries. We have first the combing of the wool, then the spinning of the combed wool into yarn, the weaving of the yarn into cloth, and finally the making of the clothing. But if the products of all these industries are added together to give the value of the gross products of manufactures, it is obvious that the same values must be reckoned in several times. That some of these industries are separately entered is obvious from the fact that cottons appear on the same plate as the seventh, and woollens (no doubt including worsteds) as the ninth in point of the value of their products among the industries of the United States. On plate 180 we have a statement of the total value of manufactures less the cost of materials; but this again leaves us in perplexity, for if the values of the products of all the industries separately entered are added together after the deduction of those of the raw materials, it is evident that the same values must be deducted several times.

We cannot but think that many of the maps and diagrams under the head of Manufactures might have been dispensed with, and replaced with advantage by others relating to the mining industries of the United States, on which this volume gives us no information. The inclusion of large-scale maps indicating both the quantity and value of the principal economic minerals produced in different parts of the United States would have been very welcome.

G. G. C.

THE MECHANICS OF VOLCANOES.

THE mystery of the volcano has always attracted the human intellect, and, from the days of Empedocles onward, has been an object of investigation and speculation. Many are the theories which have been broached, none of which gave a complete explanation, and most of which have been more or less completely abandoned as the advance of knowledge showed the baselessness of their foundations, or their want of agreement with observation. This same advance of knowledge has enabled us to come nearer to a true explanation, and the latest attempt to solve the problem is contained in a paper by Prof. C. Doelter.* His explanation is not completely satisfactory in detail, yet it probably represents an approximation to the truth, and, as such, deserves the attention of geographers, for an appreciation of the cause of volcanic activity—though, strictly speaking, this is a branch of geology—is essential to the proper understanding and classification of the forms of volcanoes.

Prof. Doelter's explanation is based on the results of recent physico-chemical investigations, and involves two main principles, the first of which is the variation of melting-point with pressure. The lava of Vesuvius melts at a temperature of about 1900° Fahr. (1050° C.) under ordinary atmospheric pressure, but when subjected to greater pressures the temperature at which fusion takes place rises at the rate of about one-twentieth of a degree for each atmosphere; this increase is not, however, continuous, for there can be little doubt that in the case of lava, as of other substances, the rise of melting-point gradually reaches a maximum, after which any further increase of pressure leads to a lowering of the melting-point. As both pressure and temperature increase with depth below the surface, there must come a level below which all rocks are in a state of fusion, but it is not probable that this maximum melting-point is of practical importance, for even if we take the mean rate of increase of temperature at only one-fifth of the mean observed rate near the surface, which is about one degree Fahrenheit in 60 feet, the increase of underground temperature would overtake the rising melting-point at a depth of not more than 70 miles, while the maximum melting-point would not be reached under a depth of from 100 to 200 miles.

From these considerations, it follows that below the outer crust of cooled and solidified rocks there must be a larger zone of rock which still remains solid, because its temperature is less than that of the melting-point corresponding to the

* "Zur Physik des Vulcanismus." *Sitz. ber. K. Akad. Wiss. Wien*, 112 (1903) pp. 681–705.

pressure under which it rests, and below that again there must be rock or magma in a state of fusion; it is to this magma that Prof. Doelter looks for the original, or primary, source of all volcanic activity. At the same time the depth at which this primary reservoir of magma lies, and the pressure under which it is confined, are so great that a direct eruption from it is inconceivable, but when, by movements in the overlying crust or otherwise, a channel is opened, the magma may rise to a depth where it is surrounded by rock at a lower temperature than the melting-point. In these circumstances solidification commences, and the second principle comes into play, and, if the depth below the surface is not too great, is the direct cause of an eruption.

This second principle is the separation of aqueous and other vapours from the solidifying magma.

From all volcanoes large quantities of steam, of carbonic acid, and other gases are evolved, and the course of every lava-stream is marked by clouds of steam evolved from the cooling lava. At one time—and the idea is still common—this steam was supposed to have been derived from sea-water which had obtained access to the molten lava while still underground, but this explanation is now generally rejected, being impossible in some cases and inadequate in all, and the greater part of the steam and other emanations from a volcano are now regarded as directly derived from an original store in the interior of the earth. However this may be, it is certain that the magma from which volcanic lava is derived is not merely in a state of igneous fusion, but is combined with water and gases, which are given off as it solidifies, and by their escape frequently form miniature volcanoes, or *hornitos*, on the surface of lava-streams. If the solidification takes place underground, the steam and gases are expelled in the same way, and, if there is no free escape, pressure may increase, till it becomes great enough to overcome the resistance of the overlying rock, and so lead to an eruption and the formation of a volcano, whose character will depend on the nature of the reservoir from which the eruption took place.

This solidifying reservoir of magma, forming the secondary or immediate source of volcanic activity, may be one of those masses of magma intruded through a narrow channel of communication, which solidify into the laccolites of geology. In this case the narrow channel of communication with the central source will solidify while the overlying accumulation remains fluid, and as this solidifies the included steam and vapours are expelled. If these vapours have a means of escape through crevices in the overlying rock, they may give rise to fumaroles or hot springs, otherwise pressure will increase and may become sufficient to force a way to the surface, giving rise to one of those circular depressions known as pit-craters, or to a simple volcanic cone of the character of the "puys" of Auvergne. The opening of a passage to the outer air relieves the pressure on the solidifying magma, the melting-point is correspondingly reduced, and part may pass back into a liquid state, expanding as it does so, and by this expansion a quiet extrusion of lava may follow the explosive stage.

Volcanoes of either of the types mentioned are distinguished as monogene by Prof. Doelter. Their activity is almost always limited to a single outbreak, though a large reservoir may give rise to a second or even a third eruption during its solidification; in any case, the term of activity is necessarily limited, for as soon as the molten magma has completely solidified the source of energy is exhausted, and no further eruption can take place.

This explanation is inapplicable to great volcanoes, like Vesuvius, built up by a countless series of eruptions succeeding each other intermittently over a long period of time; here no isolated reservoir, however capacious, could conceivably suffice for the calls on it, and we must look to the great original source of molten magma in the interior of the Earth, from which there must be a wide channel of communication to those depths from which an eruption can take place. In this channel magma rises to levels where the temperature falls, solidification commences, and the vapour tension rises till it is sufficient to drive out the overlying magma, whether solidified or still fluid, and so give rise to an eruption; this leads to a lowering of pressure, and consequently of melting point, the solidifying magma becomes fluid once more, and rises in the channel, pressure increases again, the fresh magma which has risen from below begins to solidify, and the cycle repeats itself.

Such, briefly put, is the theory of volcanic activity proposed by Prof. Doelter; in his paper it is elaborated in greater detail than can be given here, but there are certain calculations dealing with the question of the depth from which eruptions take place which are of sufficient interest to be quoted. The depth of the primary, or original, source of magma is almost beyond determination; it may be as much as 100 or 200 miles, but is probably less. That of the secondary, or immediate, source is more amenable to determination.

By different lines of reasoning, it is concluded that the immediate source of activity in the case of Vesuvius must have a temperature of about 2300° to 2550° Fahr. (1300° to 1400° C.), and as the lower of these temperatures represents the melting point at a depth of 12½ miles, we get an appropriate idea of the maximum depth from which eruptions take place. It must be remembered that they may actually start from much shallower depths.

Prof. Heilprin's book * is mainly devoted to the consideration of a phenomenon which is not provided for in Prof. Doelter's theory, but is not inconsistent with it. The great spine of Pelée, which was developed after the eruption of 1902, is one of the two interesting, because unexpected, phenomena which attended this outburst of volcanic activity. The beautiful illustrations, with their brief and clearly worded explanations, which exhibit the nature of the phenomenon more clearly than any verbal description could do, will be welcome whatever may be thought of the explanation favoured by the author. It is certainly, as he urges, inconceivable that there should have been a "general and united solidification within the chimney of the volcano over a surface having a diameter of 350 to 500 feet or more, accomplished so rapidly as to prevent all overflow," but we are not aware that this view was ever held. The question at issue is whether the spine was an old solidified core, the relic of an older eruption, or composed of new lava belonging to the last outburst; it is indubitable that the spine, rising to 1000 feet above the crater, must have had a root to support it, as much as the tooth which it so strikingly resembles, and a probable explanation of its origin is that it consisted of solidified lava, still hot enough to be plastic under sufficient pressure, which was squeezed out from below much in the way that leaden rods are made by forcing lead through a small aperture. The explanation is a conceivable one, given sufficient pressure from below—equally required by Prof. Heilprin's theory.

Among the other illustrations are some interesting ones of wine-glasses which have been softened and deformed by the heat and pressure of the ashes brought down by the "black cloud," and attention is drawn to this as a probable explanation of the deformation which has been noticed in some of the glass vessels dug up from the ruins of Pompeii.

R. D. O.

* 'The Tower of Pelée. New Studies of the Great Volcano of Martinique.' By Angelo Heilprin. Philadelphia and London. 1904. Pp. 62 and 23 plates.

REVIEWS.

AFRICA.

The Kamerun.

'Kamerun und die Deutsche Tsadsee Eisenbahn.' Von C. René, Unter . . . Mitarbeit des Herrn Prof. Dr. F. Wohtmann. Berlin: E. S. Mittler u. Sohn. 1905. *Maps and Illustrations. Price 6s. 6d.*

In this manual the author, a traveller with considerable knowledge of the Mohammedan states of Central Africa, takes summary stock of the most promising of the German colonies in respect of its geography, geology, climate, vegetation and fauna, population, natural waterways, trade, and railway capacities. The work, which is written in a clear, genial style, and animated by an undertone of colonial enthusiasm, is provided with three maps, one of them incorporating hitherto unpublished surveys and a number of illustrations, but has yet to be provided with an index. Geographically the colony is distinguished into four main sections: (1) The southern part, stretching northwards to 4° N. lat. and comprising some 40,000 square miles, consists of hilly woodland rising from the flat coast to over 2000 feet high, but gradually declining towards the east. (2) To the north, again, is the Kamerun highland proper, a plateau-like formation crossed by high mountain ridges and *massifs*, but falling off gently towards the east. Abutting on the Central African highland, this region is the source of numerous rivers flowing to all the cardinal points. It rises in terraces to over 4000 feet high, and the question of its availability for cattle-rearing settlements will come up later on for determination. In any case, it seems to the author in every way well adapted for cotton culture. Its area is roundly calculated at 130,000 square miles. (3) Further north the highland sinks into the Chad lake depression, and of this region Germany claims over 10,000 square miles. (4) In the south-west of the colony there rises by the sea the volcanic *massif* of the Kamerun mountains, which, with its spurs, may cover an area of about 3500 square miles. The mighty Kamerun mountain occupies by itself some 80 square miles. As to the economic resources of the colony, the richly basaltic region of the coast, more particularly about the Kamerun mountains and in Bakossiland, as also in Adamaua, is credited with decided fertility. The coast region is covered with a mighty primeval forest, in places much more than 100 miles broad. The red and yellow earth, too, the product of the weathering of archaic rock, which constitutes the main basis of the colony, is claimed to be much more fruitful than the coffee lands of east Usambara. In the low flat lands of the south and the Bakossi mountains, Prof. Wohltmann finds a vast area of most fertile soil, holding out the best promises to plantations of every kind. In respect of temperature, Duala has a yearly mean of 77·5° Fahr., and in the warmest month (February), 80° Fahr. In Bali the temperature ranges from 63° to 67·5°. In the mountain lands the climate is fairly cool. The rainy season is March to October, whereas December to February is almost rainless. Thunderstorms are frequent. In the coast region the rainfall is heavy, the west and south sides of the Kamerun mountains approximating to the rainiest places of the world. The population, hitherto reckoned at 4 to 5 millions, is by Prof. Wohltmann estimated at 10 to 12 millions at the very least. In the north are towns of large population. Bamum has 60,000 inhabitants; Dikoa, 35,000 to 40,000; Ngaundere is larger than Dikoa. Starting from Rio del Rey on the Nigerian frontier, the railway will skirt the shore south-eastwards to Port Victoria. The next station, Duala, is the chief harbour of Kamerun, a town of 23,300 inhabitants, possessing ample elbow-room, and, in the author's estimation, every qualification for unlimited commercial development. From Duala two lines are projected: a north-east line to the Chad lake, and an eastern line following the lower and middle course of the Sannaga.

AMERICA.

History of Canadian Discovery.

'The Saint Lawrence Basin, and its Border-lands. Being the Story of their Discovery, Exploration, and Occupation.' By Samuel Edward Dawson, LITT. D., F.R.S.C. *With Illustrations and Maps.* (The Story of Exploration. Vol. 4. Edited by J. Scott Keltie, LL.D., Sec. R.G.S.) Pp. xl., 451. London: Lawrence & Bullen, Ltd. 1905. 8vo. *7s. 6d.*

This admirable history of the river of Canada, dedicated to Sir Wilfrid Laurier, is well worthy of its position in its series. The King's printer at Ottawa has found time, amid the pressure of Parliamentary duties, to give us a volume of scientific history which almost approaches a romance. It is an advantage, too, that only a portion of a continent, and not a whole continent, is here set before us. The first volume in this series, also full of romance, was not quite commensurate in size with the importance of its subject.

In the introductory sketch of the discovery of America, it is interesting to read of the little son of Geoffry Chaucer, for whom his father compiled a treatise on the astrolabe, which also shows that the study of astronomy in its practical application to latitude and longitude was a favourite one among the learned in England in the fourteenth century. To Spain, Portugal, and Italy, however, are due the first steps towards the discovery of America, and the intellectual and the commercial prominence of the Italian people can best be realized when we reflect that a Genoese, Columbus, discovered America for Spain; a Genoese-Venetian, John Cabot, discovered the mainland for England; a Florentine, Juan Verrazano, created a claim for France by his voyage along the northern coasts and Acadia; while the whole Western world was named America after another Florentine, Amerigo Vespucci.

The discovery of the Western world was largely assisted by the island outposts upon the western ocean, such as Fayal, in the Azores, famous for its connection with Martin Behaim. But among these islands on the early charts are many existent only in sailors' fancy, and William Faden's Atlas, published in London as late as 1766, actually gives Magda island and Green island.

The Behaim globe, still preserved in Nuremberg, shows that it was no surprise to the scholars and mariners of Europe when Columbus found land across the western ocean, but the surprise was when the land found proved not to be Cathay. Even in the Royal Commission to Cartier, and in the maps of the French school of cartography, it was thought that on the north Asia was continuous with the northern part of America.

The first discoverer of what is now the Dominion of Canada was John Cabot, of Genoa, who sailed from Bristol, and in 1497 landed upon the shore of one of the eastern provinces of Canada, while in that and the following year he sailed along its Atlantic seaboard, as well as along the outer coasts of Newfoundland. Bristol, the second city in all England, was well to the front in the path of discovery, even before 1497, and it is comforting to our national pride to read that it was an English ship and an English crew which first touched the continent of America, though the moving spirit was an Italian, born in Genoa and trained in Venice.

King Henry VII. cautiously empowered the Cabots to sail "with as many mariners . . . as they will have them . . . *upon their own proper costs and charges*," and his subjects were to give the Cabots "all favour and help . . .

in supplying them with stores and victuals *to be paid for by their own money.*" Great as were the results of Cabot's discoveries, his grave is unknown and unhonoured, and after four hundred years of neglect, a small memorial tower has been erected on Brandon hill, at Bristol. Yet Spain, even in the day of her humiliation, could care for the remains of Columbus, while his descendants are still grandees of her once magnificent empire. As concerns the first discovery of the new lands, the claims of Sebastian Cabot, the son of John Cabot, may be left in the formula originated by the able and eccentric Mr. Henry Stevens of Vermont—

"Sebastian Cabot — John Cabot = 0"

The last mention of John Cabot is the note of payment of his pension to Lady Day, 1499, discovered in 1897, in the Westminster Abbey Records, by the late Mr. C. H. Coote, of the Map Department of the British Museum.

In the next reign we find the first letter on record sent to England from America, from John Rut, at the harbour of St. John, to King Henry VIII., and in the thirty-third year of that king we find the first English statute referring to America, on "Newland," or Newfoundland. Dr. Dawson records a quaint expedition, in 1536, of some thirty barristers "of the Innes of Court and of the Chancerie," who sailed for Newfoundland, and all but died of starvation. But they seized a French ship which arrived just as they were casting lots who should be killed, and returned home. The king had to compensate the Frenchmen liberally for the piracy of his learned counsel.

The Portuguese had been equally active in exploration, and by 1534, the date of Jacques Cartier, the whole Atlantic seaboard of the Dominion of Canada had been explored. Cartier sailed from St. Malo on April 20, 1534. His second voyage sailed on May 16, 1535. The original narrative of this voyage, the 'Bref Recit,' was published at Paris in 1545, and the only copy known is in Mr. Thomas Grenville's Library at the British Museum. A new edition, with a translation, is shortly to be issued by Mr. H. P. Biggar, one of the ablest archivists of the Canadian Government. It is strange that the Hakluyt Society has issued no edition of any travels in Canada, though in 1859 they issued a translation of Samuel Champlain's 'Voyage to the West Indies and Mexico, 1599–1602.' Samuel Champlain succeeded Jacques Cartier, and sailed from Honfleur on March 15, 1603. The last half of this interesting volume gives a bright and succinct sketch of the French exploration of Canada and its great rivers, and a vivid picture of the self-devotion of the Jesuit missionaries, ending up with an account of the settlement of M. Menier, whose name, along with some others in the text, has unfortunately been omitted from the index. The reproductions of early maps, and portraits, the illustrations of scenery, and Mr. J. G. Bartholomew's orographical map of the St. Lawrence basin, on a scale of 1 : 5,000,000, leave little to be desired.

B. H. S.

South American Rivers.

'Estudio e Projecto sobre Navegação a Vapor do Rio Negro.' Por Leonidas Norzagaray-Elicechea. London: 1905.

This *brochure* contains much of geographical interest regarding the great valley of the Rio Negro affluent of the Amazon, as well as the country drained by the headwaters of the Orinoco river and its south-western tributaries. The author has travelled extensively in these regions, and his explorations have led him to propose to the Government of the state of Amazonas the navigation by steam of the upper Rio Negro and its branches, and the establishment of a great commercial avenue between Manaos and the Orinoco by way of the isthmus of Pimichin, as well as by that wonderful waterway, the Casiquiari canal, which connects the Amazon and Orinoco river systems. His plan includes the removal or avoidance of the obstructions existing in the Rio Negro at San Gabriel and Camanaos in the 25-mile stretch of the river. He even proposes to open a commercial *route* from Manaos to Bogotá, and, as a result of his personal explorations, he states that "a natural, open, continuous detritic formation, or macadam, of 900 feet average width and uniform level, separates the Meta and Vichada rivers, and descends from San Martin, on the eastern slope of the cordillera of Sumapaz to the river Orinoco."

Since 1860, a treaty has been in existence between Brazil and Venezuela, which fosters a transit commerce between the two countries; but the obstacles to navigation have prevented the development of any important trade. No doubt, if they could be removed or avoided at a moderate expenditure, the upper valleys of the Orinoco and Rio Negro, which are very rich in indiarubber, might find an outlet *viâ* the river Amazon, and thus avoid the dangerous falls and rapids of the middle Orinoco. The Rio Negro is navigable for light-draft craft the entire year, except at the short stretch of rapids above named.

The production of indiarubber in the Casiquiari district is already considerable, and is stated to be about one hundred tons yearly.

In colonial times the border-land between the Amazon territory of Portugal and that of Spain in the Orinoco valley was held to be of much value by the respective contestants for its possession, and many small forts were built at strategical points. Among others, the fortresses of San Felipe, Marabitans, and St. Gabriel were built between 1754 and 1763, and, on the confines of the Rio Branco branch of the Rio Negro, several points were fortified during the last half of the eighteenth century to also protect the district from advances up the Essequibo river, the portage across the water-divide being very easy, and only a mile long. Nearly all of the above-named forts were abandoned by 1788.

The Casiquiari canal was discovered in 1744 by the Jesuit father, Manuel Roman, and became the ordinary route between the Catholic missions of the Orinco and Rio Negro.

Many writers have called attention to the possibility of connecting the Plata river system with that of the Orinoco by a navigable water route through the heart of the continent; but, so far as the upper Paraguay, the Guaporé, and river Madeira are concerned, it is a scheme impracticable of realization, owing to hundreds of miles of rapids and falls; but a project looking to the removal of the obstacles which exist between the Amazon and upper Orinoco, *viâ* the Rio Negro, and the establishment of a valuable avenue for traffic by steamers to develop the great resources of an immense area of country, seems to be worthy of careful, detailed study by the state of Amazonas.

G. E. C.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Surveying.

'Text-book of Topographical and Geographical Surveying.' By Major C. F. Close, C.M.G., R.E. London: Printed for H.M. Stationery Office by Harrison & Son; sold by Wyman & Sons. 1905. *Price* 3*s*. 6*d*.

Major Close has at last filled a gap in technical literature which has long wanted filling. For years past there has been a slow but very steady advance in English geographical schools, the tendency of which has been to place England more on a level with her continental neighbours in matters relating to the acquisition of map knowledge of her widespread possessions beyond the seas, than was possible under the restrictions which necessarily distinguish Ordnance Survey methods. No standard work on topography, as applied to continents rather than counties, has previously existed in the English language, unless we make an exception of Mr. Wilson's 'Topographic Surveying,' which is certainly a valuable summary of the principles of the art from the American point of view. Major Close leaves nothing to the imagination, although he wisely confines himself to the strict limits of his subject, declining to enter into the tempting field of geodetic discussion (on which science there is already an ample literature), and dealing only with those practical issues which bear directly on the final attainment of sound topographical maps. For the first time, too, we have all those branches clearly defined, and the relative value of the map results properly co-ordinated with the object they are meant to serve. The place of topography in the wider field of geography is well maintained, and the principle that it is just as scientific to make approximately accurate mapping (so long as it will always fill its own place in the world's geography without error and without distortion) as to labour through all the preliminaries of geodetic arc measurements, and thus be left hopelessly behindhand in the practical results of useful map-making, is clearly intimated. In short, it is a practical work all through—as a text-book should be—and it is to be earnestly hoped that it will form the basis of topographical instruction in all the geographical schools in England.

So full and so complete is the work in the matter of forms, tables, and illustrations, that it would take a long time to refer to all those features of it which deserve special recognition. The illustrations are excellent, and if any criticism can be applied to them it is that they are almost too good. One or two specimens of the very roughest and readiest form of topographical art, as applied by highly trained Indian explorers to districts over which they may have to carry a reconnaissance at the rate of hundreds of square miles per diem, would not have been out of place in a work of this sort.

From the commencement of the book we note that Major Close insists on the importance of a preliminary basis of triangulation, or traverse, for topography, and rightly maintains the advantage of such a basis over any form, or combination of forms, of astronomical observation. His remarks on the preliminary base measurement include a reference to those newer methods which have been introduced by French experts, which render the process of rapid measurement so much more accurate than was formerly possible. It is for this reason, perhaps, that he does not insist forcibly on the necessity for a constant repetition of linear measurements during the extension of the reconnaissance (or "geographical topography"), which was adopted till lately as the best means of compensating error. All the most useful methods of carrying out what we may term irregular triangulation are well explained, but we may, perhaps, note that it has been found in practice *always* necessary to introduce an azimuth value derived from astronomical observation with the computations for interpolating a position by triangulation, whether from three or more points or from two. Whilst Major Close very rightly insists on the uncertainty which attends latitude checks owing to inconstant level deflection, he perhaps depreciates the value of such checks a little too far. The uncertainty must always exist, but in practice it has not been found to invalidate their usefulness to any great extent.

The chapter on the use of subtense instruments for traversing purposes is most useful. It is an essential detail in topographical surveying which is often overlooked. The use of the plane-table is advocated by an expert at the process. One small detail may perhaps be emphasized even further than by the italics which

Major Close gives it. *Pins should never be used* to assist the plane-tabler to align his ruler. It is a slovenly expedient which is too often made use of. I have seen a plane-table that looked like a pin-cushion in a military school lately.

The chapter on "Surveys on Active Service" is altogether good. There is a point about map-reproduction in the field which is perhaps worth more discussion. The sun-printing processes (blue prints and the like) can be made use of with far greater facility than either lithography or zincography. The latter may be superior in their results, but the advantage of illustrating the first despatches after an action by a sketch-map made during its progress, and reproduced with the utmost rapidity, are not to be overlooked. It might very well happen that at the close of an extended action covering 8 or 10 miles of front, the position of every brigade could be indicated to the general commanding by means of a series of sketch-maps made during the course of the action, traced and printed within an hour or two, given that light was available. This would hardly be possible by any other means than sun-printing. On the subject of map projections Major Close is perhaps the best authority in England, and he treats the subject liberally. The story of British mapping might possibly be considered as hardly appropriate to a text-book; but the moral of it is far too important to allow of its omission. That moral is best given in Major Close's own words, "No system of sketching, no combination of sketches, and no compilation of previously unconnected material, whether sketches, isolated surveys, or from plans, will result in a trustworthy topographical map." The grand ruling principle of working from the whole to a part, and not *vice versâ*, is the keynote of the whole book—the golden rule which must surely govern all English surveys in the great future before them.

The subject of astronomy as an adjunct to topography is well and fully illustrated. Due value is given to the various methods of determining longitude, and Major Close gives expression to the opinions of all experienced topographical and geographical surveyors in his summary of this subject. It might be expressed as follows: "Never take an observation for an abstract value of longitude if you can obtain that value differentially by telegraph; never use the telegraph if you can get a differential value by triangulation."

Taking it for all in all, it is the best book on topography that has yet appeared in the English language, and will certainly serve as a standard guide for all the many geographical schools in the country.

T. H. H.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Ocean Commerce.

'The Organization of Ocean Commerce.' By J. Russell Smith, PH.D., Instructor in Commerce, University of Pennsylvania, No. 17 of the series in Political Economy and Public Law of the Publications of that university. Philadelphia: 1905.

This is an excellent work, which must prove indispensable to all who are interested in commercial geography. The nature of the work is exactly indicated by its title. The volume develops systematically, with respect to ocean transport, the corollaries that flow from the great facts relating to transport—that commodities are always carried most economically in the largest vehicles, provided only that the vehicles can always be filled; that the cost of carriage is more or less enhanced where goods cannot be conveyed directly to their ultimate destination, but have to undergo one or more handlings and changes in the mode or the means of conveyance; that the loss of time in carriage is serious, especially in the case of certain commodities; and that losses are also involved in uncertainty as to the time of despatch and arrival of goods. These facts are not geographical. The geographer has to accept them as he accepts a multitude of other facts which are not geographical; but, accepting them, he has to inquire into the geographical conditions that in consequence of them favour or hinder economy of transport; and in applying them to ocean transport, he has to take into account three other great facts—one not geographical, the others at least partly so. The first of these three facts is that ocean carriage is essentially cheaper than any other method of transport. So far as this arises from the circumstances that ocean-carriage is water-carriage, and consequently involves less friction in the movement of a vehicle, this fact is non-geographical; but so far as it arises from the ocean being a great free highway leading in a countless variety of directions, one that allows of the use of vehicles of any dimensions, and one on which a free source of power is more or less available, it is geographical. The second of the three facts referred to is that competition tends to reduce the rate of carriage, and this is, of course, non-geographical. The third is that the getting rid of competition by monopolistic organization is much more difficult in ocean than in land transport, and this is geographical, inasmuch as it is the result of the actual distribution of land and water.

Bearing in mind all these facts, then, what the geographical student of ocean transport has to do is to consider such questions as these. What are the local circumstances that favour the accumulation of a full cargo at one seaport destined for some other seaport, and especially a full cargo for a large vessel, as well as a full return cargo? If the full return cargo is impossible, what are the conditions that favour the shortest voyages without cargo or without full cargo? What are the conditions that favour the regular going and coming of fully laden large fast vessels? And so forth. It is just such questions as these that Dr. Russell Smith considers, and his inquiry enables us to understand why it is that even at a time when steamers are acquiring a larger and larger share of ocean carriage the British seas still swarm with schooners, barques, and other small sailers; why large sailers still carry considerable quantities of heavy bulky commodities, like coal, timber, grain, jute, etc., between distant shores; why a port like Galveston exports goods to thirty or forty times the value of those which it imports (from abroad); why Belfast sends abroad a much greater value of raw cotton than it does of all British and Irish commodities put together, even including ships; why the prices of Cardiff coal in some cases bear little relation to the distance from Cardiff; and a number of other facts of commercial geography which at the first blush may seem surprising.

Dr. Russell Smith's monograph, apart from an introductory chapter on the character and importance of ocean traffic, and a concluding chapter discussing tendencies in commercial organization, is divided into three parts. Part i. deals with traffic, and considers the conditions that favour charter or tramp traffic, that is the carriage of goods according to the demand of the occasion, and line or regular traffic, as well as what is called berth traffic, which is a sort of hybrid between the two, a tramp steamer being advertised to sail on a particular date on a certain route, either unconditionally or on the condition of a stated quantity of traffic being secured for the date announced. In this part the conditions determining freights are also considered. Part ii. deals with routes and shipping, and includes chapters on coal supply and coaling stations, the competition of sailers and steamers, the Government control of shipping and supervision of ocean routes, as well as a very interesting chapter on the probable effects of the Panama canal, in which the author, on the assumption of a toll being fixed on a non-paying basis, gives cogent reasons for taking a more favourable view of the range and amount of traffic likely to pass through that canal than that which is taken by Colonel Church in his paper in vol. 19 of the *Geographical Journal*. Part iii. is devoted to harbours and port facilities. A map of the world shows ocean trade routes, both sailing and steamer, coaling-stations (distinguishing the leading commercial coaling-stations from those in which 500 tons of coal or more may be obtained) and telegraph connections, as well as the limits of the trade winds in the northern summer and the northern winter, of the prevailing westerly winds, and of the monsoons. These last, it must be confessed, are not easy to understand, and are not in agreement with the usual accounts of the monsoons or the wind directions shown in the maps of the ocean winds in Bartholomew's Atlas of Meteorology.

Dr. Russell Smith does not give many bibliographical references, his work being mainly the result of personal inquiry and observation, not only in America, but in most of the leading ports of Europe. "The chapter upon the handling of freight is, in nearly every paragraph, the result of direct observation."

G. G. C.

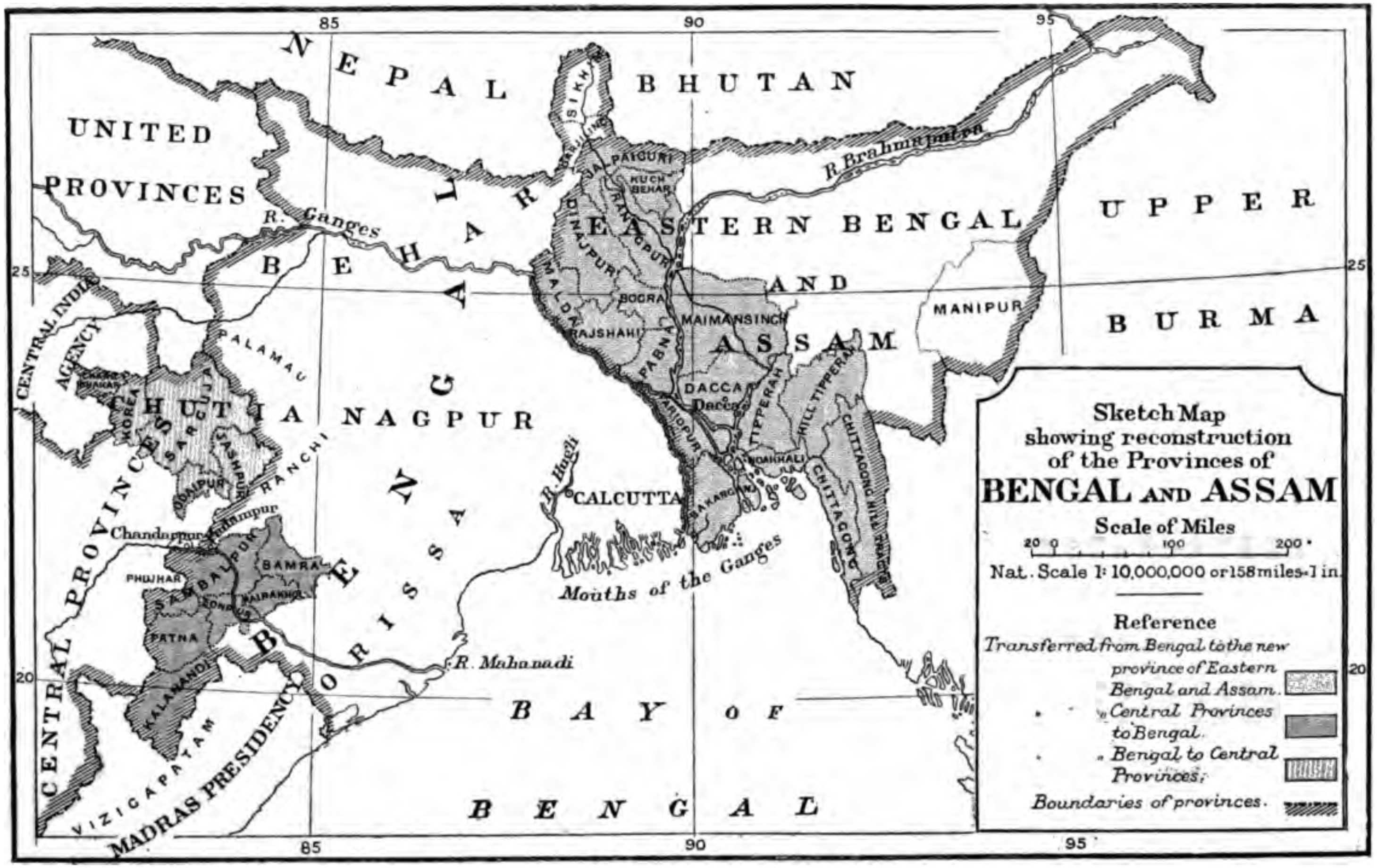
THE MONTHLY RECORD.

ASIA.

Dr. Sven Hedin's New Expedition.—Dr. Sven Hedin has already reached Constantinople *en route* for Persia, where he proposes to thoroughly explore, from a scientific point of view, the salt deserts of Dasht-i-Kavir and Dasht-i-Lut in the eastern part of the country. He hopes afterwards to proceed through Afghanistan to India, and there organize an expedition for the exploration of Central Tibet.

The Bengal-Assam Reconstruction.—The accompanying sketch-map shows the territorial adjustments which have been made for the purpose of relieving the Bengal administration of the undue burden entailed by the vast increase of its population. The details of the arrangement were explained fully in the September number of the *Journal* (p. 330), to which the reader may be referred. It will be seen that the area with the darkest shading in the map is formed by the bulk of the Sambalpur district, together with the five Uriya-speaking states which have been transferred from the Central Provinces of Bengal in deference to the desire of the Uriya-speaking peoples to be united under one administration. The lightly-shaded area to the north, on the other hand, represents the five native states, all with a Hindi-speaking population, which have hitherto been attached to the Chutia Nagpur division, but are now transferred to the Central Provinces. The large area in Eastern Bengal, now united with Assam, includes the whole of the Chittagong, Dacca, and Rajshahi divisions, together with the districts of Malda and the state of Hill Tipperah.

The Hugli River and its Navigation.—In a paper read before the Institute of Civil Engineers in January last, and printed in vol. 160 of the *Proceedings* of that body, Mr. L. F. Vernon-Harcourt supplied a valuable summary of our knowledge of the Hugli and of the changes that have taken place in its channels since accurate surveys have existed. He also outlined the various proposals which have been made for improving the navigation, and put forward suggestions of his own for that object. The writer himself made a careful examination of the river in 1896, and has since made a study of all existing charts, including those issued by the Survey department of the Port of Calcutta commission since 1896. The paper opens with a sketch of the physical characteristics of the Hugli, which, as the writer points out, like the rest of the mouths of the Ganges, presents the somewhat unusual conjunction of being tidal for many miles from the sea, and yet


Sketch Map
showing reconstruction
of the Provinces of
BENGAL AND ASSAM
Scale of Miles
Nat. Scale 1: 10,000,000 or 158 miles=1 in.
Reference
Transferred from Bengal to the new province of Eastern Bengal and Assam.
" Central Provinces to Bengal.
" Bengal to Central Provinces.
Boundaries of provinces.
NEPAL
BHUTAN
UNITED PROVINCES
EASTERN BENGAL AND ASSAM
UPPER BURMA
BEHAR
CHUTIA NAGPUR
BENGAL
ORISSA
BAY OF BENGAL
CENTRAL PROVINCES
MADRAS PRESIDENCY
CENTRAL INDIA AGENCY
MANIPUR
R. Brahmaputra
R. Ganges
R. Hugli
R. Mahanadi
CALCUTTA
Mouths of the Ganges
DACCA
CHITTAGONG
CHITTAGONG HILL TRACTS
HILL TIPPERAH
TIPPERAH
NOAKHALI
MAIMANSINGH
BOGRA
RAJSHAHI
PABNA
MALDA
DINAJPUR
RANGPUR
KUCH BEHAR
JALPAIGURI
SIKHIM
PALAMAU
RANCHI
SARGUJA
JASHPUR
KOREA
SAMBALPUR
BAMRA
PATNA
KALAHANDI
PHULJHAR
SONPUR
RAIRAKHOL
Chandarpur
VIZIGAPATAM
85
90
95
25
20

belonging to a vast delta. It is not merely, however, one of the many mouths of the Ganges, but receives an independent supply of water from its western tributaries, of which the Damuda is the chief. Unlike the deltaic branches of tideless rivers, the Hugli, in its lower course, expands into a widening estuary encumbered by sandbanks, which has been formed by the action of the tide. The figures given for the fresh-water discharge into the Hugli are very striking, both for the enormous difference between high and low water, and for the great volume at the former, in spite of the small proportion of the whole discharge of the Ganges which reaches the sea by this mouth. The maximum flood discharge below the confluence of the Rupnarayan is reckoned at 1,350,000 cubic feet per second, of which 200,000 are derived from the Ganges; 450,000 from the tributaries above Calcutta; and 700,000 from the Damuda and Rupnarayan; the above total being reached, however, only when the various sources are simultaneously at their maximum. Towards the close of the dry season a minimum of about 21,000 cubic feet is reached. The ratio of alluvium discharged during the year to the total fresh-water discharge is calculated at 1 in 2444, which is nearly identical with the ratio assigned in the case of the Mississippi (1 in 2420), but less than that given for the Rhone (1 in 2166). The paper enters fully into the tidal *régime* of the river, and compares the influence of tidal flow with that of the fresh-water discharge in forming its channel. The latter is of importance as an agent in scouring out a channel during freshets, thus preventing silting by the sediment brought in by the flood-tide during the dry season. It is the tidal influx, however, which alone provides the navigable depth during two-thirds of the year, while, with the reverse movement at ebb, it prevents the formation of a bar. The writer holds that the navigable condition has deteriorated of late years, and thinks that, though the idea of artificial improvement of the estuary is out of the question, something might be done to lessen the difficulties in the narrower part of the river, especially at the dangerous James and Mary shoal, and one or two other points. The paper gave rise to some discussion and correspondence, Mr. Vernon-Harcourt's belief in the deterioration of the channel being contested, while a doubt was expressed whether the scheme proposed could be carried out for anything like the estimated sum (£170,000). Among the schemes lately put forward, one has in view the formation of a coaling-station and jetties by the Bengal-Nagpur Railway at a point on the lower river, thus avoiding the worst obstructions, but at the same time robbing Calcutta of its present trade.

AFRICA.

Components of the Nile Sudd.—An account of the manner of growth and botanical composition of the Nile sudd is given by Mr. A. F. Broun, Director of Woods and Forests in the Sudan, in the *Journal of the Linnean Society* (vol. 37, No. 258, 1905). The chief plants which combine to form these floating masses of vegetation are well known; but Mr. Broun's paper gives a clearer idea than any previous description of the comparative *rôle* of the individual species and the variation in the composition of the sudd according to local conditions. Four plants are named as the chief sudd-formers, viz. *Cyperus papyrus*, *Panicum pyramidale* (*om-suf*, or "mother of wool," of the Arabs), *Phragmites communis*, and *Typha australis*; the ambatch, sometimes spoken of as one of the main constituents of the sudd, being not considered entitled to rank in this category. Next in order come eight twiners and climbers, including three species of Ipomea, which play an important part in binding the mass together; while a considerable list of accessory sudd-formers (including the ambatch) follows, besides a still longer list of plants which grow on periodically inundated land. This last includes a considerable number of trees, which are often found growing in the midst of the sudd, and may have originally started growing on the floating masses. The four primary sudd-formers (especially the *Panicum* and *Phragmites*), and, among the climbers, *Ipomœa reptans*, have tubular rhizomes, which interlace and contribute to the formation of rafts of considerable buoyancy. At the Lake No end of the marshes the fringe of papyrus (which requires a certain depth of water) is continuous for many miles, large stretches of *Typha* occurring, however, in the shallower water behind this hedge. Towards the south the papyrus is more and more replaced by the tall *Phragmites* reed; while the *Panicum*, which has the faculty of growing in both shallower and deeper water than the papyrus, not only occupies ground periodically uncovered, but also forms an outer fringe in the bed of the channel. Mr. Broun considers that the whole extent of the swamps once formed a lake which has gradually silted up from the south. In course of ages the whole would, no doubt, become firm land without the intervention of man, though the interests of the country demand that the process should be hastened.

Exploration in the Kamerun.—A tract in the interior of the Kamerun—at no very great distance, indeed, from the coast—which has hitherto been virtually unknown, is that stretching north-east from the Manenguba range, a line of hills 5° N. which forms the northern watershed of some of the streams entering the Kamerun estuary. It has lately been explored and mapped by a military expedition sent to this district for punitive purposes under Colonel Müller (*Deutsches Kolonialblatt*, August 15, 1905). The exact route followed cannot be traced on any existing map, but Colonel Müller gives some general notes on the nature of the country and its inhabitants, both of which he and the officers under him studied in some detail. The country traversed does not form a single geographical unit, the foothills of the Manenguba range being separated from the interior plateau by a broad depression drained by the Nka or Nkam, shown as a tributary of the Vuri on the best existing maps. The range falls gradually to this low ground, but the ascent to the plateau is steep. The population is divided up into small sections without cohesion, but trade is fairly active. The people have shown no great willingness to submit to European influence, until convinced by experience of the futility of resistance. The country is generally well cultivated, and in places the close proximity of the farms gave it quite a European aspect. Rice might be cultivated on the lower grounds, rubber on the plateau, and cotton on the steppes of the Bamum country.

The Water Question in the South African Steppes.—Inasmuch as the whole future of many of the more arid parts of Africa (to say nothing of other continents) is bound up with the question of water-supply, all researches dealing with this subject from a scientific point of view are of great importance. Such an examination of the question, as concerned with the underground water and its evaporation, is undertaken by F. Gessert in the *Zeitschrift für Kolonialpolitik*, etc., vol. 7, part 4, 1905. The writer discusses first the mechanism of the evaporation of ground-water, as brought about by the circulation of air within the ground, and afterwards treats of the effects of such evaporation and the various agencies by which it is increased or diminished. The subject is a somewhat obscure one, and, as the writer insists, much research is needed before all the problems connected with it can be solved. His conclusions may not all be accepted without controversy, but his paper is valuable as showing the practical importance of the subject and the need of scientific training on the part of those who take in hand the amelioration of arid regions. Herr Gessert points out the important influence exercised by the evaporation of ground-water on the general meteorological conditions of a country, and finds that an increase in its amount has, as its result, a diminution of rainfall. In general its result must therefore be detrimental, though instances are given in which it may be advisable to stimulate the process, for the sake of cultivation, either by pulverizing the surface soil or by raising the level of the ground water. It is necessary, however, to guard against rendering the surface soil too salt by the latter means, though in certain cases the salt soil is beneficial from its greater capillarity, and can be utilized for the cultivation of salt-loving plants. The principal cause of the increase of evaporation now in progress is the destruction of vegetation, and much might be done to check it by scientific afforestation, the date-palm being eminently suitable for planting in the whole southern part of German South-West Africa. The ways in which cultivation by the aid of irrigation may check the evaporation of ground-water are stated to be the following: The moist surface soil presents greater obstacles to the penetration of air than dry soil would. Moreover, any air which does penetrate takes up moisture in the process, and can therefore exercise a smaller drying effect on the lower layers. The damp surface also prevents the great fall of temperature which takes place by radiation from dry soil. The growth of vegetation without artificial irrigation (which can often be dispensed with when a start is once made) has a similar effect. The general conclusions are as follows: The loss by evaporation of ground-water is far greater than by the flow of water above or below ground, and ground-water is a much more valuable source of supply than river-water conserved in reservoirs. An improvement in climate can be brought about by bringing the evaporation process from the lower levels to the surface, though this must be done on a very large scale before an increase of rainfall can result.

The Masai Uplands. Erratum.—The name of the author of the letter on this subject in the October *Journal*, p. 466, is wrongly spelled in the text and the map; it should be *Meinertzhagen*.

AMERICA.

Mammoth Remains and Ice-sheets in Alaska.—An expedition was despatched to Alaska in 1904, under the auspices of the Smithsonian Institution, for the purpose of investigating the remains of the mammoth and other large animals of former times, which have been long known to exist in that country under somewhat similar conditions to those of the Siberian tundras. The investigation was placed in the hands of Mr. A. G. Maddren, who has described his search and its results in vol. 49 of the *Smithsonian Miscellaneous Collections* (Washington, 1905). The district selected for the search was that of the Porcupine river, the great northern tributary of the Yukon, on a tributary of which—the Old Crow river—many indications of the existence of such remains in large numbers were discovered, though a shortage of supplies unfortunately rendered it necessary to return before any place of primary entombment of the animals had been reached. The evidence obtained was, however, sufficient to allow the conclusion that an extensive deposit of large Pleistocene mammal remains—represented principally by mammoth, bison, and horse—does exist on the headwaters of the Old Crow river, which enters the Porcupine from the north-west some 60 miles above the Hudson Bay Company's former post at New Rampart house. Mr. Maddren made a careful study of the Quarternary deposits of this region, especially the Pleistocene silts which occupy a large part of the surface, and in association with which the remains appear to occur. He also paid much attention to the accumulations of land-ice, which here, as in Siberia, occur in conjunction with the Pleistocene deposits. His report, in which his views on these points are fully discussed, is therefore an important contribution to the much-vexed question of the recent geological history of these northern regions, both of Asia and America, the general conditions showing a striking similarity in both. In certain directions he is distinctly at variance with the views generally held by geologists, and it is interesting to note that the well-known views of Sir H. Howorth as to the past climate of these regions seem to him fully borne out by the facts observed. He maintains that there are no facts to support the contention that the climate of the Arctic and sub-Arctic Regions has ever been colder than it is now. The Pleistocene deposits of Northern Alaska show no trace of glacial action, except in so far as the material was probably derived from the streams issuing from the great glaciers of the mountain area to the south. The observed deposits of land-ice *overlie* the Pleistocene silts, and belong to the Recent period, in which the comparatively favourable climatic conditions which prevailed during the Pleistocene have suffered a progressive deterioration. The principal ice-sheets are undoubtedly of lacustrine origin, and it is not permissible to conclude, as has been done in the case of the Siberian ice-deposits, that any such sheets are undoubtedly derived from accumulations of snow. Mr. Maddren believes that most of the large mammals in question became extinct with the close of the Pleistocene, owing to the deterioration of the climate. While all the remains so far discovered in Alaska come under the category of *secondary* depositions, the state of preservation of the bones indicates that they have not been carried far, and it is suggested that more complete remains are most probably to be met with on the shores of the Pleistocene lakes, from which the bones hitherto collected appear to have been drifted by ice.

The Kluane District, Yukon Territory.—The summary report for 1904 of the Canadian Geological Survey contains a report by Mr. R. G. McConnell on the Kluane district, lying along the north-east border of the St. Elias range in the south-west part of the Yukon territory. Until about six years ago the country on this side of the St. Elias range was practically unknown, and it is only since the presence of gold on some of its streams was reported in 1903 that attention has been directed to it. As elsewhere, the great range is here exceedingly rugged. Viewed from the hills on the north it presents a complex of sharp, broken, crest-lines, irregular in direction and rising in places into bold rocky prominences, some exceeding 10,000 feet in height. The small streams which drain the northern slopes occupy deep narrow valleys, but the larger streams have wide valleys which extend back into the range for many miles. The central part of the range is covered by almost continuous snowfields, and the largest glacier, the Kaskawulsh, has a length of over 20 miles. Two large rivers issue from it, flowing respectively to the Yukon and to the Pacific. The former (Slims river) enters Kluane lake, which is drained by Kluane river to the White river, the recipient of all the drainage flowing northward from the range. The latter (the Kaskawulsh) joins the Dezadeash river, the combined stream passing through the mountains to the ocean as the Alsek. The country north and east of the range is characterized by broad interlocking valleys, separating groups of mountains, some of which have heights of 5000–7000 feet. The valleys (pre-glacial) are much older than the present drainage system, and the rivers do not fit them. An important topographic feature is the great Shakwak valley, which extends in a longitudinal direction, and is occupied by a number of separate rivers and lakes, including the Kluane. The Alsek river has twice been dammed in comparatively recent times, probably by the extension of glaciers across its valley, and formed lakes of which the beaches are still to be seen. The white spruce is the most important tree of this district. The report describes the geology in detail, two distinct provinces being distinguishable—that of the St. Elias range (mostly Upper Palæozoic), and that of the flanking ranges to the north, formed principally of quartz-mica schists, probably of Cambrian age.

The Zuñi Salt Lake.—This is a small lake occupying a striking depression in the gently sloping floor of the Carrizo valley, New Mexico, from which the Zuñi Indians have furnished themselves with salt for many centuries. It has once or twice been described by geologists, but no certain solution of its mode of origin has yet been forthcoming. The latest discussion of the problem is in a note by Mr. N. H. Barton, of the United States Geological Survey, in the *Journal of Geology* for April and May, 1905, which is illustrated by a map, sections, and photographs. The plain in which the depression occurs is composed of Cretaceous sandstones, in part overlain by lava-flows, while round the margin there is a widespread mantle of fragmental material, mostly volcanic. The walls of the depression (which measures about a mile across) are about 150 feet high, and the bottom is flat and in part occupied by the lake, in part by mud flats. From its centre two volcanic cones rise, one with a deep crater occupied by a pool, which stands at the same level as the main lake, but, though very salt, is less so than the latter. In spite of the abundant traces of volcanic activity in the neighbourhood, the depression itself is not a crater, though it seems probable that its origin is connected with volcanic phenomena. The most plausible explanation seems to be that, after the ejection of the lava-sheet which covers the plain, there was a great ejection of hot water, which dissolved a thick mass of salt, and spread over the surface a large quantity of *scoriæ* and rock fragments, the space thus left being filled up by subsidence over the area now occupied by the depression.

The Plateaus of Tropical America.—In the August number of the American Geographical Society's *Bulletin*, Dr. J. Russell Smith discusses the economic importance of the plateaus of Central and South America, showing the striking contrast which exists between these areas and the rest of the world as regards the altitudinal grouping of population. While in Europe, Asia, and North America it is on the fertile plains and in the river valleys that all the great aggregations of population are met with, in Central and South America the comparatively infertile plateaus form the home of the bulk of the inhabitants. Hardly any of the State capitals are at the same time ports, but the larger number lie on the interior tablelands at a distance from the sea, communication with which is often a matter of difficulty and danger. It is, of course, necessary that they should possess outlets to the ocean for the disposal of their products, and thus in almost every case we find a port on the coast associated with a seat of government and industry in the interior. The population of these ports bears, however, but a small proportion to that of the interior cities. The unnatural character of this grouping is emphasized by a consideration of the paucity of the plateau-products compared with those of the lowlands. The reason is, of course, the unhealthiness of the low-lying areas, but Dr. Smith does not admit that this will necessitate the indefinite continuance of the abnormal state of things above described. He looks to the recent great advance in the knowledge of tropical disease to permit in time the adequate settlement and development of the tropical American lowlands, and holds that this will bring about transformations in world-trade of a magnitude witnessed but once before in the history of the world—at the time of the settlement and development of the Mississippi valley. The result will be a virtual re-discovery of the New World during the present century.

POLAR REGIONS.

Schemes for Polar Exploration.—Among the tracts within the Arctic circle that have not yet been traversed by any expedition, the most interesting from the explorer's point of view is probably that lying between the American Arctic archipelago and the New Siberia islands north of Asia. Even if the currently accepted view (based on Nansen's discoveries) of a deep polar basin occupying the greater part of the still unknown area be correct, it is by no means impossible that some yet undiscovered land-masses of limited extent may exist on the outer margin of this basin. Rumours of land to the north of Bering strait have gained currency from time to time, and to solve the question would be a good piece of geographical work. Two young aspirants for geographical honours have already set themselves this task. Mr. A. H. Harrison has started on an expedition to the waters of Arctic America by way of the Mackenzie river, bearing practically the whole cost himself, though he has received the loan of instruments from our Society, as well as some of the equipment of the recent Antarctic Expedition. On the other hand, a young Dane, Mr. Einar Mikkelsen, who has had considerable experience of Arctic travel as a member of the Amdrup expedition of 1900 and the Baldwin-Ziegler expedition of 1901–2, proposes to start for the same region as soon as sufficient funds can be collected. His idea is to travel by land to the mouth of the Mackenzie, and thence make his way, by the help of the Government schooner stationed at Cape Bathurst, to winter quarters on the south-west point of Banks land. In the spring of 1907 he hopes to set out from a depôt previously established at Prince Alfred cape, on a sledge journey of exploration to the north-west, taking numerous soundings, and examining any land that may be discovered. Another interesting task awaiting execution is the survey of the east Greenland coast between the point recently reached by the Duke of Orleans and that reached by Peary from the opposite coast. This Mr. Mylius Erichsen, whose recent expedition to the opposite site of Greenland has frequently been alluded to in the *Journal*, proposes to attempt, while paying attention also to various departments of scientific research, as well as to the artistic representation of the scenes to be visited. Lastly, a more ambitious scheme was put forward at the recent International Economic Congress at Mons, the proposal being to establish an "International Association for the Study of the Polar Regions," under whose auspices the remaining problems of polar geography might be solved. The scheme, which originated in Belgium, appears still to be somewhat in the air, and few of the leaders of polar discovery have yet given it their support.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Indian Ocean Expedition.—A letter from Mr. Stanley Gardiner is printed in *Nature* for October 6, giving an account of the scientific work done by the *Sealark* down to the arrival at Mauritius on August 5. This marked the completion of the work in and around the Chagos archipelago, which had been both oceanographical and biological, the former carried out mainly by Commander Somerville and his officers, often under great difficulties. It included both surveys by camping-parties and deep soundings from the ship, with observations on the tides, currents, temperatures, etc. All operations had been hampered by the unexpectedly bad weather experienced, the heavy seas being explained as partly due to the comparatively shallow waters of the Chagos archipelago, partly to the current, which set in an easterly direction, against the wind, during the whole time the party were in the group. The results of the soundings show that the archipelago is closely surrounded, both to the north and west, by the 2000-fathom line, and that there is at the present day no trace in the topography of the Indian ocean of any former connection of the group with either the Maldives or the banks on the Seychelles-Mauritius line. It appears to stand by itself, being built up on a plateau rising to a depth of 800 fathoms in an ocean of an average depth of 2300. The numerous lines of soundings run between the individual banks and shoals have given depths of 400 to 800 fathoms. The archipelago consists, broadly speaking, of the Salomon, Peros Banhos, and Blenheim atolls in the north; the Great Chagos bank in the centre; and the Diego Garcia and Egmont atolls in the south; besides submerged banks in the north and south. Especial attention was given to the survey of Salomon atoll, for the sake of affording a comparison with Powell's chart of 1837; but the result showed that the latter was too carelessly made for any close comparison to be possible. The new observations show that the atoll rises, in the last 400 fathoms, by similar slopes to those of Funafuti, though it is a much simpler atoll, having only one passage, and more than half the reef being crowned by land. The present reef is extending outwards on every side on its own talus, and in this case, at least, the steep external slope is simply that at which the *débris* come to rest in the water. It was everywhere extremely barren, and the appearance of the dredges from below 250 fathoms gave the idea of bare rock with a little muddy sand. It seems impossible that any upward growth is in progress between the banks, while a considerable current is probably felt even at 500 fathoms. The reefs of the Chagos are in no way peculiar save in their extraordinary paucity of animal life (which gives the marine fauna the character rather of the temperate than of the tropical zone), though this is compensated for by the enormous quantity of nullipores, the seaward edges being practically formed by their growths. The bottoms of the lagoons are bare rock, hard sand, or mud, with shoals arising precipitously here and there. Diego Garcia lagoon (almost entirely surrounded by land) has perhaps the most varied fauna, and this atoll alone gives evidence of enlarging in every direction. It shows signs of a recent elevation of a few feet. The land fauna is largely dependent on the flora, and this (which originally included a forest of large trees) has been in great measure destroyed to allow of the planting of coconuts. About 140 species of plants (probably only half of them indigenous) were collected. Of mammals there are only rats and mice. Among the more numerous birds, noddies, frigates, and terns were breeding in enormous numbers on certain slands, though it was mid-winter. The next cruise was to be largely a dredging one towards the Seychelles.

Relations between the Floras of Africa and South America.—Prof. Engler has approached the much-debated question of a former land-connection between Africa and South America from the point of view of the affinities between the existing floras of the two continents (*Sitzungsberichte* K. Preuss. Akad. Wissenschaften, 1895, parts vi. and vii.). Although, perhaps, the majority of geologists now believe in the existence of such a connection in Jurassic times, the fact is by no means universally admitted, so that corroborative testimony from an independent standpoint is of much value, and in the present case its force is increased by the fact that Prof. Engler was once inclined to discredit the idea, but has now been led, by careful study of the plants of the two areas, to consider a former land-connection probable. The paper first discusses the conclusions to be drawn in general from the existence of allied families, sub-families, etc., in widely separated regions, especially in the case of plants which afford no special facilities for dispersal. The author lays stress on the influence of external conditions on the development of plant-forms, and the resulting impossibility of allied members of a group having been developed independently from a primitive type; the conclusion being that affinities between existing forms do really imply a close association (in space) between earlier representatives of the family. Prof. Engler then examines in detail the principal species which exist in both the continents in question side by side with endemic forms, dividing them into twelve categories, according to their life-conditions and means of wide dispersal. He finds that while for nine of the groups the presence of the common forms in the two continents could be explained by transport under existing conditions, in the case of the remaining three this is in the highest degree improbable. In these groups there are a striking number of corresponding (rather than identical) species or genera, which seem to demand the existence—at a time when the angiosperms had already reached an advanced stage of development—of a connection between Madagascar, Africa, and South America, either continental or at least in the form of a chain of large islands, more especially as many of the forms are totally wanting in tropical Asia. It is a striking fact that a preponderance of the common forms belong to formations (such as that of the moist forests) members of which are least of all likely to obtain a footing as new-comers, while another noteworthy point is the presence both of steppe and forest plants, for the simultaneous migration of which only lands of considerable extent would afford facilities. The Jurassic connection supposed by geologists would explain a still greater affinity than exists, had the angiosperms reached a sufficient development at that time. It has to be considered whether the supposed connection may not have been maintained through Cretaceous or even Eocene times, in the former of which, as has been shown by recent research, angiosperms were already represented in considerable numbers.

Botanical Geography at the International Botanical Congress in Vienna.—At the first scientific sitting of the Congress on June 13 last, several addresses were delivered on the subject of the development, since the Tertiary age, of the flora of Europe. Prof. Penck discussed its geographical bases. The development since the Tertiary age fell under the influence of the ice age, the climatic conditions of which had only in quite recent times been so far investigated as to supply some measure of evidence respecting the altitudinal position of the snow-limit of that period. Thence conclusions might be drawn regarding the tree-limit, which in the coast region ran at a level at least 2000 feet, and in the interior of the continents over 5000 feet, lower. These conclusions implied that during the ice age mid-Europe stood above the forest limit, and consequently that the domain between the great northern and the Alpine glaciation belonged, as to its flora, to the Alpine and tundra region. As much might be said of the bordering domain of Western Europe. In Eastern Europe the snow-limit stood considerably higher than in mid-Europe, but dry winds must have prevailed here during the ice age, giving rise to steppe-like features. Possibly a part of the Eastern European loess was the dust of these steppes. The forest land of Europe during the ice age occupied the north Mediterranean region where western winds prevailed. The ice age consisted of at least four glacial periods of the type indicated. During their sway the glacier-covered regions were, with the exception of the scanty vegetation on the moraines, devoid of plant life. Successively buried under ice, this domain must always have been freshly occupied by plants during the inter-glacial periods. Our knowledge of these inter-glacial plant formations was still very slight. Northern Germany and France, however, were forest lands, and in the Alps the forest reached higher than it does at the present day. South-Eastern Europe appeared, however, to have been steppe-land during these periods. Of the inter-glacial flora of the north and the south of our part of the globe we know nothing. There was, however, a remarkable similarity between the inter-glacial Alpine flora and that of to-day, especially in view of the established fact that during the last glacial periods it was virtually driven out of the Alps.—Prof. Engler then dealt with the main features of the development of the flora of Europe since the Tertiary age. In no other land of Europe were so many floral regions conjoined as in Austria-Hungary, where nearly all the European floral domains met together. It was, accordingly, no accident that an Austrian, Franz Unger, was the first to point out with certainty that the distribution of plants was to be explained, not from the present climatic conditions, but as the result of processes of bygone ages. Primitive types of plants still existing in sub-tropical regions were, in fact, found as early as in the Tertiary age. In Greenland and Norway, on the other hand, there were pines, cypresses, and Scotch firs that to-day had their habitat in Eastern Asia. After the ice-age the tree flora prevalent in our time was developed anew. The fig, the laurel, and the vine were perhaps introduced into Europe by man. Through cattle-rearing and agriculture man had, by industrial works and by railways, laid a destructive hand on the vegetable vestment of the Earth, and the regret which this action called forth could only be allayed if, in accordance with the precedent setting apart the National Park in America, inviolable reserves were also set apart in Europe, and in larger measure than had yet been witnessed, as a sanctuary for existing and traditional plant formations.—Dr. Gunnar Andersson spoke of the "Floral Development of Scandinavian Lands." Here the period of development was naturally shorter than in the Alps. Five periods were to be distinguished: those successively of the Arctic-Alpine flora, birch forests, coniferous forests pure and simple, oak forests, pine and beech forests, as also the period of propagation of cultural plants at the hands of man who, be it noted, had now been settled in southern Scandinavia some 10,000 years.—Lastly, Herr C. A. Weber treated of the "History of the Development of the Flora of the North German Lowland." From the Oligocene period it was covered by the sea, whence it emerged only during the later Pliocene period. The earliest vegetation of this latter time was marked by the appearance of the vine in the West. At a later stage of this pre-glacial period there appeared marsh lands of alder trees. Later followed an Alpine vegetation characterized by a variety of the Armorica pine and the mountain pine. This vegetation gave place to a high northern tundra, which at last got buried under advancing land-ice. In the same way the vegetations of the inter-glacial periods were completely extinguished, one after the other, by the ever-advancing ice-masses. During the inter-glacial periods there stood extensive pine forests; at their beginning and end the Scotch fir prevailed. During the melting of the glacier-masses of the last Glacial period the region was occupied at first by a northern Alpine flora, marked by polar, willow and Dryas. On this followed at long intervals the Scotch fir, the oak, and lastly the red beech. The pine did not immigrate into the western parts of the lowland till towards the end of the oak age. The beech appeared after the post-glacial sinking of the land which took place in the region of the Baltic and North sea. The single drier period in the post-glacial age of north Germany, as yet demonstrated, was not so dry as to then impose on the land steppe characteristics. There possibly took place, nevertheless, at that period an immigration of such steppe plants as may still at this day be found here and there.

Observations on the Gulf Stream.—An interesting study, in detail, of the data supplied by ships' observations in regard to the rate of flow of the Gulf Stream has been carried out in the *Annalen der Hydrographie* for the present year (vol. 33, part vii.). The study is based on the observations of drift during the passage across the Atlantic made by the captains of German ships during the period between May 10 and June 10 of last year, and though fuller results might have been obtained had the number of observations been greater, these are sufficient to give a good general idea of the behaviour of the Gulf Stream water in its passage across the Atlantic from its exit from the Gulf of Mexico. The drifts observed are plotted on a series of charts dealing in succession with a series of short periods, and with the whole period taken together, somewhat after the fashion of the synoptic weather-charts of the North Atlantic, the amount of drift being shown graphically by arrows of varying size. The principal results of the inquiry are summarized thus. As compared with the mean rate of flow, the observed rates, proceeding from west to east, were alternately too small and too great. The decrease in the rate in an easterly direction did not take place regularly, but after falling off for a space the rate again showed an increase. Irregularities were also observed in the manner in which the current died out; in the position in latitude of the central stream; in the rate at given positions, etc. As a rule, a westerly counter-current was observable to the north and south of the main current, sometimes even exceeding this in speed. The influence of fresh or strong winds was observable even in the case of the strongest flow, both in the direction of acceleration and of retardation. Lastly, no unusual acceleration over the whole area, such as had been reported during the period in question, really took place, in spite of the evidence of strong drifts in individual cases. These sometimes reached as much as 70 nautical miles in twenty-four hours between 75° and 50° E., while in the neighbourhood of the Florida coast the highest figure was 86 miles in the same period.

The Accordance of Alpine Summit Levels.—It has long been remarked that even in the case of intensely folded mountain ranges, a certain degree of accordance in the altitudes attained by the principal summits is observable, though no universally accepted explanation of the fact has been arrived at. The subject is discussed with much acumen in a paper by Dr. R. A. Daly in the *Journal of Geology* for February and March, 1905 (vol. 13, No. 2). Dr. Daly points out that the possible explanations of the fact are of two radically different types, the one set regarding it as the result of inheritance from a former stage in the cycle of evolution, the other as due to spontaneous development in the present environment. Of the former group of hypotheses, that which has hitherto met with most favour in America is the well-known peneplain theory, which no doubt appeals to many from the tempting analogy it offers with the accordance in the case of a dissected plain underlain by rocks of horizontal structure. But, however acceptable it may be in certain cases, this theory has the disadvantage, which places it in marked contrast to all other possible explanations, that it demands at least two cycles of erosion in the history of the mountain chain, differing completely in the nature of the processes involved. The internal structure and original relief is considered the result of intense folding and thrusting, while the movements following on the establishment of the peneplain must be of the nature of broad, relatively gentle warps. The alternative hypotheses have also in their favour that they are not mutually destructive, and thus acquire a certain cumulative force. The observed accordance may be explained, apart from the peneplain theory, as the result of isostatic adjustment during the early history of the range, the existence at any time of summits towering far above their fellows being rendered improbable by the consideration that few rocks could withstand the enormous pressure involved. An early accordance may also have come about through differential erosion, which would always act most forcibly on the highest summits. Various agencies, too, might develop such an accordance during the later history of the range. Isostatic adjustment might again play its part, metamorphism and intrusion might work in the same direction, while important effects might result from the cutting back of glacial cirques; the greater rapidity of erosion above than below the tree-line; and from the tendency which has been observed towards the equal spacing of rivers and the resulting even gradation of intervening ridges. Dr. Daly points out the importance of making a correct choice between the rival theories in view of the widely different ideas respecting the past history of mountain ranges which they involve. He has certainly shown the need for caution in accepting the peneplain theory as the only one capable of explaining the facts.

GENERAL.

Geography at Cambridge.—We have received the regulations and list of lectures for the academical year just beginning, issued by the Board of Geographical Studies at Cambridge. The regulations appear to have suffered no change since their first introduction early in the present year, and we may therefore refer for further details to our note on the subject in the *Journal* for April last (p. 464). The first examinations held under the new regulations took place in the Easter term, and the papers set both in that for the ordinary B.A. degree and in that for the Diploma in Geography are printed in full. They are well calculated to test the extent to which the principles and educative influence of the subject have been assimilated by the candidates, though the boundary-lines between the subjects of the separate papers appear somewhat indefinite. From the questions asked it is not clear what distinction is drawn between "Ethnology" and "Anthropogeography," while the differentiation between "Regional geography," "Physical geography," and "Geomorphology" on the one hand, and between "Regional geography" and "Political geography" on the other, seems hardly so clear as it might be.

The Royal Scottish Geographical Society.—It is announced that the Livingstone gold medal of this society has been conferred on Sir Archibald Geikie, while silver medals have been awarded to Mr. R. Mossmann, of the Scottish Antarctic Expedition, Major Ryder, and Major Gibbons. The council of the society has appointed as its secretary Major Lachlan Forbes, D.S.O., late 7th Fusiliers. After the retirement of Lieut. Shackleton, early in the past summer, Major Lindsay Forbes had received the appointment, but has been obliged to retire owing to ill health. Major Lachlan Forbes is the son of General Sir John Forbes, G.C.B., and has seen a good deal of active service, having taken part in Lord Roberts's famous march to Kandahar, as well as in the late Boer war.

The Fifteenth Congress of Americanists will take place next year at Quebec, between the 10th and 15th of September. As usual, the subjects to be discussed will include the native races and archæology of America, together with the history of its discovery and occupation by white men. Membership is obtained on payment of three dollars, while associates (who take no part in the deliberations of the Congress, and do not receive its publications, though having the right to be present at all the general meetings), are admitted on payment of one dollar. The names of intending members or associates should be sent in to Dr. N. E. Dionne, Librarian to the Legislative Assembly, Quebec.

OBITUARY.

Pierre Savorgnan de Brazza.

COUNT Pierre François Camille Savorgnan de Brazza, by whose death, as truly declared by the Minister of the Colonies, "France loses one of her best and most renowned servants," was born on January 26, 1852, at Rome. He spent his youth in his native town. When thirteen years of age he was placed in a Jesuit college at Paris. In 1868 he entered the Naval Academy at Brest, and in 1870 obtained a commission in the French navy. In 1872 he was appointed one of the orderly officers of Admiral Le Couriault Du Quillot, who commanded the French squadron of the Southern Atlantic. His ship, in 1874, was at Libreville, on the Gabon, when Alfred Marche and the Marquis de Compiègne returned from an exploration of the lower Ogowe. Attention to the importance of this river had first been directed by Paul du Chaillu, its lower course had subsequently been explored by R. B. N. Walker and others, and de Brazza actually conceived the idea that it might eventually turn out to be the lower course of the Lualaba, recently explored by Livingstone, and thus open up a navigable highway into the very centre of tropical Africa. His proposals to head an expedition for the exploration of that river were sanctioned by the French Government, and on October 20, 1875, he was back at the Gabon, accompanied by Dr. Noel Ballay and Alfred Marche. The results of this expedition turned out disappointing. The Ogowe was traced to its navigable head at the Pubara falls (reached by Dr. Ballay in July, 1877); but an attempt to descend the Alima, a river flowing eastward, and supposed to lead to a large lake, was frustrated by the hostile attitude of the Bafuru; and an attempt to penetrate to the north was stopped at Okanga, a short distance beyond the upper Likona. In November, 1878, de Brazza was back at the coast, and learnt that during his absence Mr. H. M. Stanley had followed the course of the Lualaba-Congo down to its mouth, which he had reached in August, 1877. And when it became known to him that Stanley had entered the service of the King of the Belgians, and was actually engaged in taking up steamers past the cataracts of the lower Congo to Stanley pool, he proposed to the French Government to anticipate the action of the Belgians by planting the French flag at Stanley pool and along the upper river. His suggestion was adopted; £5000 were granted by Government towards his enterprise. He left France on December 27, 1879, founded a station, Franceville, on the upper Ogowe, in June, 1880; hastened down the Lefini to the Congo, and made a treaty with Makoko, the chief of the Bateke; and on September 7, 1880, arrived at Stanley pool. Having installed a Senegalese sergeant, Malamine, as guardian of an improvised station, which subsequently became known as Brazzaville, he took the route down the Congo, met Stanley at Isangili on November 7, and then hastened back to the Gabon, where he arrived on December 15. Returning to the interior, de Brazza founded a station on the upper Alima, and then turned westward, and, crossing the basin of the Niadi (Kwilu), reached Landana on the coast on April 17, 1882. His hope that the Kwilu would afford easier access to Stanley pool than a route through the cataract region has not been fulfilled, but politically he had secured for France, not only the right bank of the Congo above Stanley pool as far as 17° E., but also the basin of the Kwilu (convention of February 5, 1885).

After having recruited his health, de Brazza left France once more on March 21, 1883. He had been appointed Commissioner of the Congo Territory, and been granted £5000 towards the realization of his scheme. Arrived at Libreville on April 22, and having organized his expeditionary corps at Lambarene, he left for the interior in June, 1883, and reached the Congo by way of the Ogowe and the Alima, upon which a small steamer had been launched by Dr. Ballay. At the end of April he was at Brazzaville, and, having installed M. de Chavannes at that post, was back at the coast on December 1, 1884. In the mean time he had despatched one of his officers, M. A. Dolisie, with orders to establish himself on the Ubangi, which had but recently been navigated by Mr. Grenfell, and which he pretended to believe was identical with the Likona, or Nkunja, discovered by him in 1878. He was about to lead an expedition to that river when orders reached him, on July 15, 1885, to return to France. A year afterwards, on June 29, 1886, he was, however, reappointed Commissioner-General of the French Congo, and in February he was once more back on African soil. He held this responsible office up till January, 1898, when he was relieved of his functions and awarded, two years afterwards, a pension of £400, to be continued, on a reduced scale, to his widow. The work of geographical exploration was carried on most actively during de Brazza's tenure of office. Careful surveys were made in the basin of the Kwilu by Cornille, Gondard, and Leon Jacob, with a view to the construction of a railway; Giacomo, or Jacques, a younger brother of de Brazza,* crossed the upper Leko', or Likuala, and then traced that river to the Congo; Paul Crampel (1888–9) and Fourneau explored the country between the Ogowe and the frontier of German Camarons; Mizon came south from Yola, on the Benue (1892), and was met by Brazza himself on a tributary of the Sanga, which river had previously been explored by Cholet and Fourneau; Cholet pushed north as far as Ngauderi, in Southern Adamawa (1892–3); lastly, the region lying between the Ubangi and the Shari was reached by Paul Crampel, who perished in the attempt (1890); Jean Dybowski, who reached the Shari (1891); C. Maistre, who made his way from the Shari to the upper Benue (1892); and Gentil, who succeeded in reaching Lake Chad in October, 1897. But whilst geographical exploration thus made rapid progress, the colony made no progress economically, in spite of numerous "posts" and close upon three hundred officials, and French writers have contrasted this stagnation with the progress made by the Royal Niger Company in a much shorter time. De Brazza has been denied administrative ability, but part of the failure is no doubt due to the home authorities.

Disorders having taken place in the Congo, Pierre de Brazza was despatched at the head of a commission charged with investigating the subject. He left Marseilles on April 5 last, interviewed the Commissioner-General, E. Gentil, at Brazzaville, and then visited the frontier stations of the colony as far as Fort Crampel on the river Gribingi, a tributary of the Shari. He died on the homeward voyage, at Dakar, on September 14, only fifty-three years of age. E. G. R.

CORRESPONDENCE.

The Submarine Cañons of the Ganges and Indus.

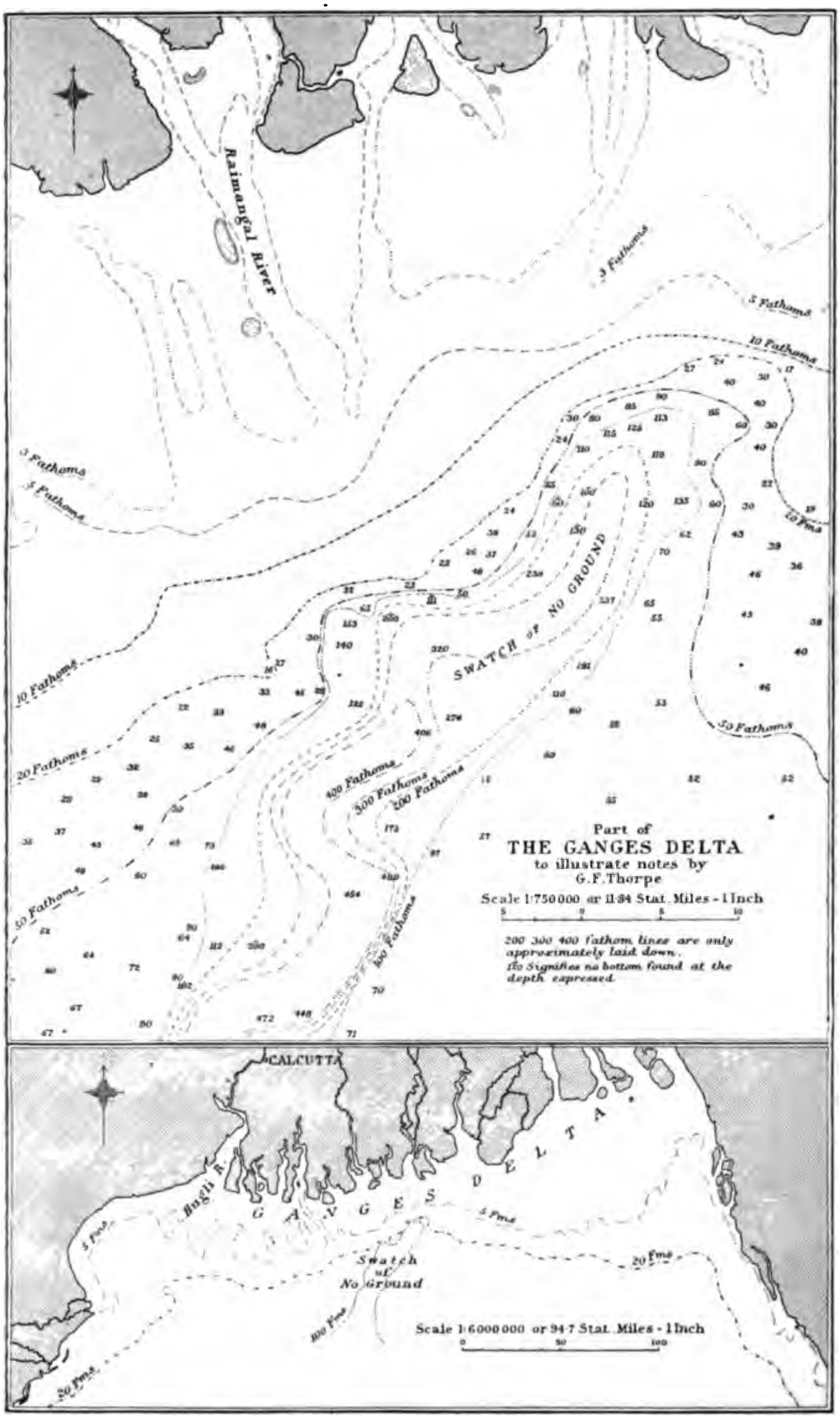
1, Garstin's Place, Calcutta, July 13, 1905.

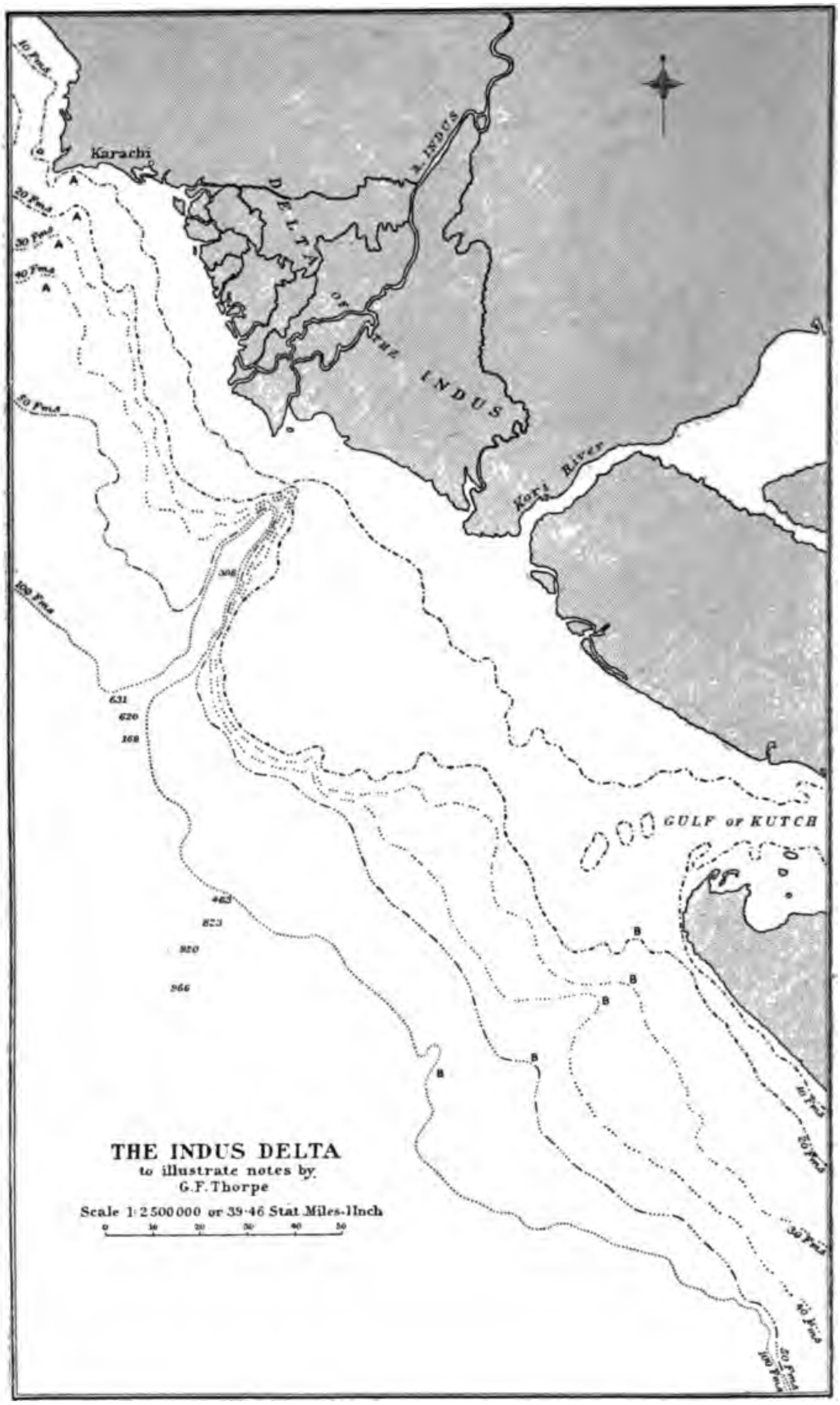
I HAVE just read Mr. J. W. Spencer's paper in the February issue of your magazine, in which he endeavours to prove the past raising of the American continent from the cañon existing off the mouth of the Hudson river. To a layman like myself it seems that, although when taken by itself and some other examples in the Atlantic it might be held to prove a past raising, when taken with the very similar ones existing off the Indian rivers, the proof is far from satisfactory.

I forward herewith a tracing of the Swatch of No Ground (so called) off the mouths of the Ganges, with the soundings taken in and around it, which, although unfortunately very few, are still sufficient to enable one to trace a very striking resemblance between it and the Hudson cañon. It is not only very nearly the same as regards depth and the changes of direction, but, curiously enough, it is situated in exactly the same position, viz. that off the Hudson pointing midway between its two banks, and that off the Ganges midway between the extreme east and west mouths of its delta.

Now, by applying Mr. Spencer's theory this would mean that in some past age Bengal must have been at least 3000 feet higher than it is at present, and probably if more and deeper soundings were taken, 9000 feet—the height allowed for the

* Giacomo de Brazza was born at Rome on December 14, 1859, and died there on February 3, 1888. Jointly with his companion, A. Pecile, he published 'Tre anni e mezzo nella regione del Congo e dell' Ogowe.' Roma: 1887.


Raimangal River
3 Fathoms
5 Fathoms
10 Fathoms
10 Fms
20 Fathoms
30 Fathoms
SWATCH of NO GROUND
400 Fathoms
300 Fathoms
200 Fathoms
100 Fathoms
Part of
THE GANGES DELTA
to illustrate notes by
G.F.Thorpe
Scale 1:750000 or 11·84 Stat. Miles - 1 Inch
200 300 400 fathom lines are only approximately laid down.
150 Signifies no bottom found at the depth expressed.
CALCUTTA
Hugli R.
G A N G E S D E L T A
5 Fms
20 Fms
Swatch of No Ground
100 Fms
Scale 1:6000000 or 94·7 Stat. Miles - 1 Inch



THE INDUS DELTA
to illustrate notes by
G. F. Thorpe

Scale 1: 2 500 000 or 39·46 Stat. Miles-1 Inch

0 10 20 30 40 50

American continent — would be the height, for the cañon is still very clearly defined where the soundings leave off.

Can this have been the case? The Ganges, so far as I know, drains a comparatively modern watershed; the greater part of lower Bengal has been built up from great depths by its silt, and it takes its rise in the Himalayas, which are of such recent origin that some authorities affirm they have not yet done rising.

It seems to me to be dead against Mr. Spencer's theory, and that to account for these cañons some other—probably a peculiar method of depositing the silt not at present understood—must be substituted, and in support of this theory I might draw your attention to the peculiar way in which the sands on both sides of the delta curve so as to point directly towards the deeper gut in the centre.

On the tracings I have given the names of the Admiralty charts from which I took them. All the soundings are correctly given, with the isobathic lines up to the 100 fathoms; the 200, 300, and 400 I have added myself, in the direction they most probably would take. The charts are easily procurable, so that any further reference could easily be got.

July 27, 1905.

In continuation of my letter dated the 13th inst., I forward herewith a tracing of the cañon off the Indus, which has a still more striking resemblance to that off the Hudson than the Ganges had, it even having the same secondary channels on either side, which I have marked A and B.

Although most of the soundings come from the chart named in the tracing, I have added some others gathered from a larger-scaled one, entitled 'India, West Coast: Chart of the Coasts of Sind and Kutch, including the Gulf of Cutch.'

Can the land surrounding ever have been 620 fathoms, or 3720 feet, higher than it is now—that being a sounding that seems to be very nearly at the mouth of the cañon?

G. F. Thorpe,
Bengal Pilot Service.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Abh. = Abhandlungen.	Mem. (Mém.) = Memoirs, Mémoires.
Ann. = Annals, Annales, Annalen.	Met. (mét.) = Meteorological, etc.
B. = Bulletin, Bollettino, Boletim.	P. = Proceedings.
Col. = Colonies.	R. = Royal.
Com. = Commerce.	Rev. (Riv.) = Review, Revue, Rivista.
C. R. = Comptes Rendus.	S. = Society, Société, Selskab.
E. = Erdkunde.	Sc. = Science(s).
G. = Geography, Géographie, Geografia.	Sitzb. = Sitzungsbericht.
Ges. = Gesellschaft.	T. = Transactions.
I. = Institute, Institution.	Ts. = Tijdschrift, Tidskrift.
Iz. = Izvestiya.	V. = Verein.
J. = Journal.	Verh. = Verhandlungen.
Jb. = Jahrbuch.	W. = Wissenschaft, and compounds.
k. u. k. = kaiserlich und königlich.	Z. = Zeitschrift.
M. = Mitteilungen.	Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Carpathians. **Martonne.**
E. de Martonne. Étude sur la crue du Jiu au mois d'Août 1900. (Extras din Analele Institutuluĭ Meteorologic al României, T. xvi., 1900.) Bucuresci, 1903. Size 12½ × 9½, pp. 77–96. *Sketch-maps. Presented by the Author.*

Carpathians. **Martonne**
La période glaciaire dans les Karpates méridionales. Par E. de Martonne. (Comptes Rendus IX. Congrès géol. internat. de Vienne 1903.) Vienne, 1904. Size 10 × 7, pp. 691–702. *Map. Presented by the Author.*

Carpathians. *C. Rd.* 141 (1905): 71–73. **Murgoci.**
Contribution à la tectonique des Carpathes méridionales. Note de G. M. Murgoci.

Central Europe. *Petermanns M.* 51 (1905): 97–108. **Ihne.**
Phänologische Karte des Frühlingseinzugs in Mitteleuropa. Von Prof. Dr. E. Ihne. *With Map.*

Central Europe. **Regell.**
Das Riesen- und Isergebirge. Von P. Regell. (Land und Leute. Monographien zur Erdkunde . . . herausgegeben von A. Scobel. XX.) Bielefeld und Leipzig: Velhagen & Klasing, 1905. Size 10 × 7, pp. 132. *Map, Panorama, and Illustrations. Price* 4 *marks.*

An excellent account of the region in question, opening with a clear sketch of the physical geography.

Central Europe. *Meteorolog. Z.* 22 (1905): 282–284. **Ule.**
Niederschlag und Wasserführung der Flüsse Mitteleuropas. Von W. Ule.

Europe—Historical. **Helmolt and others.**
Weltgeschichte . . . herausgegeben von Hans F. Helmolt. Fünfter Band. Südosteuropa und Osteuropa. Von Prof. D. Rudolf von Scala, etc. Leipzig und Wien: Bibliographisches Institut, 1905. Size 10 × 7, pp. xvi. and 630. *Maps and Illustrations. Price* 10*s.*

Europe—Meteorology. **Rung.**
Répartition de la Pression atmosphérique sur l'Europe, observée de 1881 à 1895 et direction moyenne du vent sur les littoraux. Par le Capitaine G. Rung. Copenhague, 1904. Size 17 × 10½, pp. 20. *Maps. Price* 21*s. net.*

Færoes. **[Villiers.]**
Fishing, Whaling, and other Industries of the Faroe Islands, 1904. Foreign Office, Annual No. 3404. London, 1905. Size 9½ × 6, pp. 26. *Price* 2*d.*

Færoes and Iceland. **Nielsen.**
Meddelelser Kommissionen Havundersøgelser. Hydrografi I. No. 4 (pp. 30).
Hydrography of the Waters by the Faroe Islands and Iceland during the cruises of the Danish Research Steamer *Thor* in the summer 1903. By J. N. Nielsen. *Plates.*

France. *B.S.G. Com. Bordeaux* 31 (1905): 161–163. **Saint-Jours.**
Gironde, Garonne. Par Capitain Saint-Jours.

Discusses the history of the names.

France. *Rev. G.* 55 (1905): 140–145. **Pawlowski.**
Le marais vendéen: l'ancien golfe du Poitou. Par A. Pawlowski. *With Illustrations.*

France—Aude. *B.G. Hist. et Descriptive* (1904): 253–266. **Ferrasse.**
Les cours d'eau du bassin de la Cesse, leur origine, leur évolution. Par E. Ferrasse. *With Map.*

France—Brittany. **Martonne.**
Le développement des côtes bretonnes et leur étude morphologique. Par E. de Martonne. (Travaux du Laboratoire de Géographie de l'Université de Rennes No. 1.) Rennes: F. Simon, 1903. Size 10 × 6½, pp. 18. *Map. Presented by the Author.*

France—Brittany. **Martonne and Robert.**
Excursion Géographique en Basse Bretagne. (Monts d'Arrée-Trégorrois.) Par E. de Martonne et E. Robert. (Travaux du Laboratoire de Géographie de l'Université de Rennes, No. 3.) Rennes, 1905. Size 10½ × 6½, pp. 42. *Illustrations. Presented by M. E. de Martonne.*

France—Brittany. **Robert.**
Densité de la population en Bretagne, calculée par zones d'égal éloignement de la mer. Par E. Robert. (Travaux du Laboratoire de Géographie de l'Université de Rennes. No. 4.) Rennes, 1905. Size 10 × 6½, pp. 108. *Map. Presented by M. E. de Martonne.*
See Monthly Record for September (p. 328).

France—Climate. *B.S.G. Com. Bordeaux* **31** (1905): 141–156. **Courty.**
Climatologie du Littoral Atlantique Français. Par F. Courty.

France—Gascony. **Saint-Jours.**
B.S.G. Com. Bordeaux **30** (1904): 297–306, 330–334, 337–343, 357–365.
Le Port de Soulac, les Dunes et les Étangs de Gascogne. Par Cap. Saint-Jours.

France—Gironde. *B.G. Hist. et Descriptive* (1904): 239–244. **Duffart**
La navigation en Gironde d'après le Routier de Garcie dit Ferrande (XV[e] Siècle). Par C. Duffart. *With Map.*

France—Gironde. *B.G. Hist. et Descriptive* (1904): 245–252. **Duffart.**
L'extension moderne de la presqu' île d'Ambès et de l'île du Cazeau (Gironde). Par C. Duffart. *With Maps.*

France—Glaciers. **Girardin and Favre.**
Commission française des Glaciers. Rapport sur les observations glaciaires en Maurienne, Vanoise, et Tarentaise (21 Août 24—Septembre, 1903). Par M. Paul Girardin. Observations sur les glaciers du Massif de la Vanoise, pendant l'été de 1903. Par le guide Joseph-Antoine Favre. Paris: P. Renouard, 1904. Size 9 × 5½, pp. 48. *Map and Illustrations. Presented by the Commission.*

France—Historical. *B.G. Hist. et Descriptive* (1904): 147-160. **Soyer.**
Étude critique sur le nom et l'emplacement de deux oppida celtiques mentionnés par Jules César dans les *Commentarii de Bello Gallico.* Par J. Soyer. *With Map.*

France—Meteorology. **Sorre.**
Les pluies en Vendée. Par M. Sorre. (Travaux du Laboratoire de Géographie de l'Université de Rennes, No. 2.) Rennes, 1904. Size 10 × 6½, pp. 32. *Maps and Diagrams. Presented by M. E. de Martonne.*

France—Nomenclature. *B.G. Hist. et Descriptive* (1904): 223–238. **Chauvigné.**
Recherches sur les formes originales des noms de lieux en Touraine. Par A. Chauvigné.

France—Speleology. **Martel.**
E. A. Martel. Padirac et les Gorges du Tarn (Extrait du "Tour de France," Juin et Septembre, 1904). Rennes: F. Simon, 1905. Size 10 × 13, pp. 16. *Illustr.*

France—Survey. **Neymarch.**
Ministère des Finances. Commission Extraparlimentaire du Cadastre. Rapport Général et Rapport Complémentaire sur les Travaux de la Sous-Commission des Voies et Moyens. Par M. Alfred Neymarch. Paris, 1904. Size 12½ × 8½, pp. 150.

Germany. 1 *Veröffent. G.V. Bonn* (1905): 51–70. **Hassert.**
Deutschlands Lage und Grenzen in ihren Beziehungen zu Verkehr und Politik. Von K. Hassert.

Germany—Earthquake. *Globus* **87** (1905): 405–409. **Krebs.**
Erdbeben im deutschen Ostseegebiet und ihre Beziehungen zu Witterungs-Verhältnissen. Von W. Krebs. *With Map.*

Germany—Meteorology. *G. Anzeiger* **6** (1905): 27–30, 75–78. **Polis.**
Die Wärme- und Niederschlagsverhältnisse der Rheinprovinz. Von Dr. P. Polis. *Maps.*

Greece—Mountains. *Alpine J.* **22** (1905): 413–425. **Freshfield.**
Classical Climbs. By D. W. Freshfield.

Iceland. *G. Tidskrift* **6** (1882): 71–83, 103–111. **Helland.**
Om Islands Geologi. Af A. Helland.

Iceland. **Vidalin.**
Trade of Iceland, 1901–03. Foreign Office, Annual No. 3350, 1905. Size 10 × 6, pp. 16. *Price* 1*d.*
See note in Monthly Record for October (p. 451).

Iceland. *Alpine J.* **22** (1905): 436-448. **Wigner.**
The Vatna Jökull traversed from North-East to South-West. By J. H. Wigner. *With Illustrations.*

Italy. *B.S.G. Italiana* **6** (1905): 75-84. **Errera.**
Sulla separazione del Lago di Mezzola dal Lario (età antica e medievale). Nota del Prof. C. Errera.

Italy—Sicily. **Nicotra.**
Dizionario illustrato dei Comuni Siciliani compilato da F. Nicotra. Dispensa I. Palermo: Società editrice, [1905]. Size 12½ × 8½, pp. 1-64. *Illustrations. Presented by the Publishers.*

Magyar Race. **Zichy and Pósta.**
Dritte Asiatische Forschungsreise des Grafen Eugen Zichy. III. und IV. Archæologische Studien auf Russischem Boden. Von Béla Pósta. Parts i. and ii. Budapest; Leipzig: K. W. Hiersemann, 1905. Size 12½ × 9½, pp. 600. *Illustr.*

Norway. **Henriksen.**
On the Iron Ore Deposits in Sydvaranger, Finmarken, Norway; and relative geological problems. (By G. Henricksen.) Christiania, 1904. Size 7¼ × 5½, pp. 8. *Presented by the Author.*

Pyrenees—Clouds. *Meteorolog. Z.* **22** (1905): 254-261. **Marchand.**
Marchand: Der Mechanismus der Entstehung der Regenwolken am Nordabhange der Pyrenäen. Einfluss der Erhebungen der Kette. Starke Regengüsse und Ueberschwemmungen.

Rumania. *M.G. Ges. Wien* **48** (1905): 231-232. **Weiss.**
Ein Beitrag zur antiken Topographie der Dobrudscha. Von Jacob Weiss. *Map.*

Russia. *B. Comité Géolog. St. Pétersbourg* **23** (1904): 243-250. **Kovalew.**
Compte rendu préliminaire des recherches géologiques dans l'Oural du Sud. Par P. Kovalew. [In Russian.]

Russia. **Woeikoff.**
Les ravins et les sables de la plaine Russe. Communication presentée au Congrès du Sud-Ouest Navigable de Toulouse. Par A. Woeikoff. Toulouse, 1904. Size 9½ × 6½, pp. 14.

Russia—Finland. *M.K.K.G. Ges. Wien* **48** (1905): 155-156. **Schoener.**
Die Kolonisation Südwest-Finnlands durch Schweden. Von J. G. Schoener.

Russia—Glaciers. **Shokalsky.**
Rapport sur les Observations des Glaciers en Russie pendant les années de 1902 et 1903. Par J. de Schokalsky. [In Russian.] St. Petersburg, 1905. Size 10 × 6½, pp. 22. *Illustrations. Presented by the Author.*

Russia—Kaluga. **Bogolubov.**
N. N. Bogolubov. Materials for the Geology of the Kaluga Government. [In Russian.] Kaluga, 1904. Size 11 × 8, pp. 354. *Maps and Illustrations. Presented by the Author.*

Russia—Kaluga. **Bogolubov.**
Zur geologischen Geschichte des Gouvernements Kaluga in der Glacialperiod. Notiz von N. Bogolübow. (Extrait de *l'Annuaire géologique et minéralogique de la Russie* (vol. 7, liv. 5).) St. Petersburg, 1905. Size 12½ × 9½, pp. 111-119. *Presented by the Author.*

Russia—Urals. *Le Globe B.S.G. Genève* **44** (1905): 122-124. **Duparc.**
Sur l'existence de hautes terrasses dans l'Oural du nord. Par Prof. Louis Duparc.

Spain. *C. Rd.* **141** (1905): 69-71. **Douvillé.**
Sur les Préalpes subbétiques aux environs de Jaen. Note de R. Douvillé.

Spain—Solar Eclipse. ——
Dirección General del Instituto Geográfico y Estadístico. Coordenadas geográficas de puntos comprendidos en la zona de la totalidad del Eclipse de Sol de 30 de Agosto de 1905. Madrid, 1905. Size 11 × 8, pp. 422. *Maps, Plans, and Illustrations. Presented by the Instituto Geografico y Estadistico, Madrid.*

Sweden. *B. Geolog. I. University Upsala* **6** (1902-03): 160-168. **Grenander.**
Les variations annuelles de la température dans les lacs suédois. Par S. Grenander.

Sweden. *B. Geolog. I. University Upsala* 6 (1902–03): 101–159. **Hofman-Bang.**
Studien über Schwedische Fluss- und Quellwässer. Von O. Hofman-Bang.

Sweden. *B. Geolog. I. University Upsala* 6 (1902–03): 175–199. **Högbom.**
Studien in nordschwedischen Drumlinslandschaften. Von A. G. Högbom. *With Maps and Illustrations.*

Switzerland. *Rev. Française* 30 (1905): 278–284. **Bobigny.**
Le Simplon et les voies d'accès. Par — Bobigny. *With Map.*

Switzerland—Geology. **Pannekoek, Arbenz, and Collet.**
Beiträge zur Geologischen Karte der Schweiz. 47. Lieferung. Geologische Aufnahme der Umgebung von Seelisberg, am Vierwaldstättersee. Von D. J. J. Pannekoek (pp. 26 and x.). Ditto. 48. Lieferung. Geologische Untersuchung des Frohnalpstockgebietes. Von D. Paul Arbenz. (Pp. x., 82, and x.) Ditto. 49^e^. Livraison. Etude Géologique de la Chaîne Tour Saillère—Pic de Tanneverge. Par Leon-W. Collet. (Pp. iv., 32, and xii.) Bern: A. Francke, 1904–1905. Size 12½ × 9½. *Maps and Illustrations.*

Turkey. *B.S.G. Români* 25 (1904): 136–147. ———
Statistica Comunelor Romînesti din Turcia. *Map.*
On Rumanians settled in Turkey.

Turkey—Macedonia. **Brancoff.**
D. M. Brancoff. La Macédoine et sa population chrétienne. Paris: Plon-Nourrit et Cie, 1905. Size 10 × 6½, pp. 270. *Maps. Price 3s. 9d.*

Turkey—Macedonia. *G.Z.* 11 (1905): 268–292. **Oestreich.**
Die Bevölkerung von Makedonien. Von Karl Oestreich.

United Kingdom—Archæology. *P.R.S.* (*Ser. A.*) 76 (1905): 177–180. **Lockyer.**
On the Observations of Stars made in some British Stone Circles. Preliminary Note. By Sir Norman Lockyer.

United Kingdom—Climate. *J.R. Statistical S.* 68 (1905): 247–319. **Shaw.**
Seasons in the British Isles from 1878. By Dr. W. N. Shaw, F.R.S. *With Maps.*
A valuable summary and analysis of climatic statistics, the relation between agriculture and weather being also considered.

United Kingdom—Coal. ———
Royal Commission on Coal Supplies. 13 Parts. London: Wyman & Sons, 1905. Size 13½ × 8½. *Maps and Sections.*

United Kingdom—Devon. **Somervail.**
On the occurrence of Pleistocene Deposits in the bottom of the Teign gorge. By Alexander Somervail. (Pp. 4.) On the Excavation of the Teign Gorge. By the same. (Pp. 2.) Some further observations on the Teign and its valley. By the same. (Pp. 4.) The River Teign and its valley. By the same. (Pp. 10). (From *T. Devonshire Association*, 1901, 1902, and 1904.) Size 8½ × 6½. *Presented by the Author.*

United Kingdom—England. **Crook and Weston.**
Round the World Geographical Handbooks. I. Our English Home. By C. W. Crook and W. H. Weston. London: T. C. and E. C. Jack, [*not dated*]. Size 7 × 5, pp. 64. *Maps and Illustrations. Price 6d. Presented by the Publishers.*

United Kingdom—Geology. **Fox-Strangways and Watts.**
Memoirs of the Geological Survey, England and Wales. The Geology of the Country between Derby, Burton-on-Trent, Ashby-de-la-Zouch, and Loughborough. (Explanation of Sheet 141.) By C. Fox-Strangways. With a Chapter on Charnwood Forest by Prof. W. W. Watts. London, 1905. Size 10 × 6, pp. vi. and 84. *Illustrations.*

United Kingdom—Meteorology. *Nature* 72 (1905): 178–180. **Lockyer.**
The Thames Flow and British Pressure and Rainfall Changes. By Dr. W. J. S. Lockyer. *With Diagrams.*

United Kingdom—Scotland. *Scottish G. Mag.* 21 (1905): 289–301. **Shearer.**
The Evolution of the Map of Scotland. First Stage. By J. E. Shearer. *With Maps.*
See note in the September number (p. 327).

United Kingdom—Scotland—Anthropogeography. ———
The Geography of Religion in the Highlands. By a Member of the R.S. Geogr. Soc. Edinburgh: R. Grant, 1905. Size 8½ × 5½, pp. (36). *Presented by the Publishers.*

United Kingdom—Scotland—Hebrides. *Proc. R.S., Ser. A.* **76** (1905): 181–184. **Field.**
Report on an Area of Local Magnetic Disturbance in East Loch Roag, Lewes, Hebrides. By Captain A. M. Field. *Diagrams.*

United Kingdom—Wiltshire. **Jukes-Browne.**
Memoirs of the Geological Survey, England and Wales. Explanation of Sheet 282. The Geology of the Country South and East of Devizes. By A. J. Jukes-Browne. London, 1905. Size 9½ × 6, pp. 62. *Price* 1*s*. *Presented by the Geological Survey.*

ASIA.

China—Trade. ———
China: Imperial Maritime Customs. I. Statistical Series, Nos. 3 and 4. Returns of Trade and Trade. Reports. 1904. Part i. Size 11 × 9, pp. xvi. and [64]. [In English and Chinese.] *Diagrams.*

China—Yunnan. **Sainson.**
Nun-tchao ye-che. Histoire particulière du Nan-tchao, traduction d'une histoire de l'ancien Yun-nan, accompagnée d'une Carte et d'un Lexique géographique et historique. Par C. Sainson. (Publ. l'École Langues Orient. Viv. V^e^ Sér., Tome IV.) Paris: E. Leroux, 1904. Size 11 × 7½, pp. 294. *Map. Price* 15 *fr.*

Chinese Empire—Manchuria. *J. Tōkyō G.S.* **17** (1905): 155–162. **Ogawa.**
On the Geology of Liau-tung. By Takudzi Ogawa. [In Japanese.]

Chinese Empire—Tibet. *Records Geolog. Surv. India* **32** (1905): 160–174. **Hayden.**
Preliminary Note on the Geology of the Provinces of Tsang and Ü in Tibet. By H. H. Hayden. *With Map.*

Chinese Empire—Tibet. **Hosie.**
China, No. 1 (1905). Report by Mr. A. Hosie, His Majesty's Consul-General at Chengtu, on a journey to the Eastern Frontier of Thibet. London: Wyman & Sons, 1905. Size 13½ × 8½, pp. 88. *Map. Price* 1*s*. 3*d*.

Noticed in the Monthly Record for October (p. 452).

Chinese Empire—Tibet. *J.R. United Service I.* **49** (1905): 659–679. **Iggulden.**
To Lhasa with the Tibet Expedition, 1903–04. By Lieut.-Colonel H. A. Iggulden. *With Map and Illustrations.*

Chinese Empire—Tibet—Orthography. **O'Connor.**
Rules for the Phonetic Transcription into English of Tibetan Words. (By Captain W. F. O'Connor.) Size 13½ × 8½, pp. 6.

Eastern Asia. *J.R. Colon. I.* **36** (1905): 509–539. **Ireland.**
The British Empire in the Far East. By A. Ireland.

Eastern Asia. **Halot.**
L'Extrême-Orient. Études d'hier, événements d'aujourd'hui. Par A. Halot. Avec une Préface de M. Revon. Bruxelles: Falk Fils, 1905. Size 7½ × 5, pp. 212. *Map. Presented by the Publisher.*

The writer went out to Japan, some years ago, with a view to studying the burning questions of the Far East with an absolutely unbiassed mind. He here gives the results of his observations in a series of essays dealing chiefly with the moral causes of the war of 1894–95.

French Indo-China. ———
Publications de la Société des Études Indo-Chinoises. Géographie physique économique et historique de la Cochinchine. Fasc. I.–VI. I. Monographie de la Province de Biên-hòa (pp. xii. and 58); II. Province d'Hà-tiên (pp. 66); III. Province de Gia-đinh (pp. 140); IV. Province de Mỹ-tho (pp. 98); V. Province de Bà-ria et de la Ville du Cap Saint-Jacques (pp. 66); VI. Province de Châu đôc (pp. 56). Saigon, 1901-2. Size 10 × 6½. *Maps and Illustrations. Price* 20*s*.

French Indo-China—Annam. *R. Française* **30** (1905): 342–351. **Lasalle.**
Les Côtes de l'Annam. Par C. de Lasalle. *Map.*

French Indo-China—Laos. *B.G. Hist. et Descriptive* (1904): 283–389. **Bernard.**
Les Khâs, peuple inculte du Laos français. Notes anthropométriques et ethnographiques. Par M. le Dr. Noël Bernard. *With Map and Plates.*

French Indo-China—Tongking. *B.S.G. Marseille* **28** (1904): 388–401. **Gérard.**
L'Ile de Kébao (Tonkin). Par A. Gérard. *With Map.*

India. *P.R.S., Ser. A.* 76 (1905): 313-315. **Burrard.**
On the Intensity and Direction of the Force of Gravity in India. By Lieut.-Colonel S. G. Burrard. (Abstract.)

India. **Gage.**
Annual Report of the Board of Scientific Advice for India for the year 1903-1904. Calcutta, 1905. Size 13 × 8½, pp. 22. *Price 7d.*
A summary of the Departmental reports (surveys, etc.)

India—Bengal and Assam. ———
Papers relating to the Reconstitution of the Provinces of Bengal and Assam. London: Wyman & Sons, 1905. Size 13½ × 8½, pp. 18. *Price 2½d.*
See Monthly Record for September (p. 330).

India—Ethnology. *C. Rd.* 140 (1905): 1656-1659. **Lapicque.**
Recherches sur l'ethnogénie des Dravidiens. Relations anthropologiques entre les tribus de la montagne et les castes de la plaine. Note de L. Lapicque.

India—Historical. *Indian Antiquary* 34 (1905): 73-87. **Stein.**
White Huns and kindred tribes in the history of the Indian North-West Frontier. By M. A. Stein.

Indo-China—Ethnology. *Rev. Coloniale* (1905): 321-334. **Cabaton.**
Les Chams de l'Indo-Chine. Par Antoine Cabaton.

Indo-China—Historical. *J. China Br. R. Asiatic S.* 35 (1903-4): 76-101. **Kingsmill.**
The Mantses and the Golden Chersonese. By T. W. Kingsmill.

Japan. *J. Tōkyō G.S.* 17 (1905): 53-60, 119-125. **Gakujin.**
Contributions to the Oceanography of the Tōkyō Bay. By Chinzan-Gakujin. [In Japanese.]

Japan. *J. Tōkyō G.S.* 17 (1905): 20-24. **Tanaka.**
The Temperature of Water of the Brackish Lake Hiruiga, Wahasa Province. By Akamaro Tanaka. [In Japanese.]

Japan. ———
The Fifth Financial and Economical Annual of Japan, 1905. Tokyo. Size 10½ × 7½, pp. vi., 182, and 30. *Map and Diagrams. Presented by Dr. Y. Sakatani.*

Japan—Formosa. **Crowe.**
Trade of North Formosa, 1904. Foreign Office, Annual No. 3405. London, 1905. Size 9½ × 6, pp. 18. *Price 1½d.*

Japan—Seismology. *J. Tōkyō G.S.* 17 (1905): 183-193. **Ōmori.**
On the Distribution of Earthquakes in Japan. By Fusakichi Ōmori. [In Japanese.] *Maps.*

Japan—Seismology. *J. Tōkyō G.S.* 17 (1905): 375-382. **Omori.**
On the Recent Volcanic Eruption in Japan. By Fusakichi Omori. [In Japanese.] *Diagrams.*

Korea. *B.S.R.G. Anvers* 29 (1905): 75-142. **Schmidt auf Altenstadt.**
Reisindrukken van een Hollandsche in Korea. Door von Schmidt auf Altenstadt.

Malay Archipelago—Borneo. *Scottish G. Mag.* 21 (1905): 312-315. **Burt.**
Notes on a Journey through British North Borneo. By A. Burt.

Malay Archipelago—Celebes. *Petermanns M.* 51 (1905): 118. **Hoëvell.**
Ueber die Herkunft des Namens "Celebes." Von Baron G. W. W. C. von Hoëvell.
See Monthly Record for October (p. 453).

Malay Archipelago—Gilolo. **Hueting.**
Tijds. K. Ned. Aard. Genoots. Amsterdam 22 (1905): 604-620.
Het district Tobelo op de Oostkust van Halmahera. Door A. Hueting. *Map.*

Malay Archipelago—Java and Madura.
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Nel Bahr el Gazal, lettera del missionario padre C. Tappi.

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Die ostafrikanische Südbahn. Von A. Herfurth.

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See *Journal*, vol. 25, p. 566.

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Die Grundwasserverdunstung in Steppen speciell Sudwestafrika. Von Ferdinand Gessert.
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A. Kuhns Expedition am Grossen Fischfluss (Deutsch-Südwestafrika). Von H. Seidel.

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Bericht über die astronomisch-geodätischen Beobachtungen der Expedition zur Festlegung der Grenze Yola-Tschadsee zwischen Nordwest-Kamerun und Northern Nigeria. Von Prof. Dr. Ambronn. *With Illustrations.*

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Handel und wirtschaftliche Verhältnisse des nordwestlichen Teiles von Kamerun. (Separatabdruck aus den "Mitteilungen der Ostschweizerischen Geograph.-Commerc. Gesellschaft.") Von A. Kaiser. Size 9 × 6, pp. 46. *Presented by the Author.*

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See Monthly Record for September (p. 333).

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La pénétration économique du Sud marocain: Rapport au Comité du Maroc. Par le Marquis de Segonzac.

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The Bolewa tribe. By Major G. Merrick.

Nigeria—Historical. *J. African S.* **4** (1905): 455–479. **Mischlich.**
Contributions to the History of the Hausa States. By A. Mischlich. With Introduction by J. Lippert.

North Africa. *Rev. G.* **55** (1905): 148–154. **Dupontès.**
A travers l'Afrique romaine. Par P. C. Dupontès. *With Map and Illustrations.*

Portuguese West Africa—Meteorology. *B.S.G. Lisbon* (1905): 197–218. **Roque.**
Contribuição para o estudo do clima do planalto de Mossamedes. Por A. B. Roque. *Map and Diagrams.*

Sahara. *Renseignements Colon., Comité Afrique Française* (1905): 265–267. **Mercier.**
Une harka des Doui Menia et Ouled Djerir vers le Sahel. Par L. Mercier.
Native account of a raid, by tribes of the Morocco-Algerian borderlands in the Northern Sahara, in the direction of Timbuktu.

Sahara—Tuareg. **Ahmed Bilou.**
Renseignements Coloniaux, Comité de l'Afrique française (1905): 182–187.
Le Voyage du Caïd El Hadj Ahmed Bilou chez les Touareg.
This journey, by a native in the French service, took place in 1903.

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The forming of the Drakensberg. By A. L. du Toit. *With Map.*

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Die Mambukuschu. Von S. Passarge. *With Illustrations.*

The headquarters of the Mambukushu are about the cataracts of the Okavango. The articles describe their characteristics and culture.

South Africa—Kalahari. *Z. Ges. E. Berlin* (1905): 20–36, 68–88. **Passarge.**
Die Grundlinien im ethnographischen Bilde der Kalahara Region. Von Dr. S. Passarge. *Maps and Illustrations.*

South Africa—Kalahari. *B.S.R. Belge G.* 29 (1905): 93–112. **Schoep.**
Le Kalahari. Par A. Schoep.

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La question forestière dans le Soudan. Par A. Jolyet.

The writer thinks that the wooded regions of the Sudan may be capable of limited exploitation, given suitable methods of forestry.

Transvaal—Geology. *T. Geol. S. South Africa* 8 (1905): 16–25. **Molengraaff.**
Notes on the Geology of a Portion of the Klerksdorp District, with Special Reference to the Development of the Lower Witwatersrand Beds and the Vaal River System. By G. A. F. Molengraaff. *Map and Sections.*

Transvaal—Geology. *T. Geol. S. South Africa* 8 (1905): 42–46. **Merensky.**
The Gold Deposits of the Murchison Range in the North-Eastern Transvaal. By Hans Merensky.

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The Rocks of Tristan d'Acunha, brought back by H.M.S. *Odin*, 1904, with their bearing on the question of the Permanence of Ocean Basins. By E. H. L. Schwarz. *With Maps and Section.*

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Tristan da Cunha. *Scottish G. Mag.* 21 (1905): 301–309. ——
Tristan d'Acunha. *With Portraits.*

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Canada—Rockies. *Smithsonian Miscellaneous Collections* 2 (1905): 453–496. **Sherzer.**
Glacial Studies in the Canadian Rockies and Selkirks. Preliminary Report by D. W. H. Sherzer. *Illustrations.*

Mexico. *J. Geol.* 13 (1905): 185–193. **Darton.**
The Zuni Salt Lake. By N. H. Darton. *Maps and Illustrations.*

See Monthly Record (p. 560).

Mexico. *Science* 21 (1905): 585–587, 897–899. **Hovey.**
The Western Sierra Madre Mountains. (The Greene Exploring Expedition.) By Dr. E. O. Hovey.

North America. **Preuss and Seler.**
Z. Ges. E. Berlin (1905): 361–380, 433–466.
Der Einfluss der Natur auf die Religion in Mexiko und den Vereinigten Staaten. Von Dr. K. Th. Preuss. *Illustrations.*
Einige Bemerkungen zu dem Aufsatze Dr. K. Th. Preuss über den Einfluss der Natur auf die Religion in Mexiko und den Vereinigten Staaten. Von Prof. Dr. Seler.
Antwort auf Prof. Dr. Selers Bemerkungen zu meinem Vortrage. Von Dr. K. Th. Preuss.

North America—Historical. **Schafer.**
A History of the Pacific North-West. By Joseph Schafer. New York: The Macmillan Co., 1905. Size $7\frac{1}{2} \times 5\frac{1}{2}$, pp. xvi. and 322. *Maps and Illustrations. Price* $1.25 *net. Presented by the Publishers.*

An excellent short history of the discovery and development of the north-west of North America, especially within the United States. The exploration of the west of Canada is touched upon here and there, but only incidentally. Thus no mention is made of the important journeys of Robert Campbell in the far North-West.

United States. *B. American G.S.* 37 (1905): 321–339. **Brigham.**
The Great Roads across the Appalachians. By A. P. Brigham.

United States—Arizona. *Deutsch. Rundschau G.* **27** (1905): 358–363. **Kuntze.**
Der Achatwald von Adamana. Von Dr. O. Kuntze. *With Illustration.*
On forest trees petrified *in situ.*

United States—Census. ———
Bureau of the Census. Bulletin 15. A Discussion of the Vital Statistics of the Twelfth Census. Washington, 1904. Size 11½ × 9, pp. 24.

North America—Great Lakes. *Monthly Weather Rev.* **33** (1905): 154. **Odenbach.**
Some temperatures taken on Lakes Huron and Superior in July and August of 1904. By F. L. Odenbach, S.J.

North America—Great Lakes. *Monthly Weather Rev.* **33** (1905): 47–49. **Henry.**
High Water in the Great Lakes. By Prof. A. J. Henry.
Noticed in the Monthly Record for October (p. 455).

North America—Physiography. *American J. Sc.* **19** (1905): 341–344. **Spencer.**
Bibliography of Submarine Valleys off North America. By J. W. Spencer. *Also separate copy, presented by the Author.*

United States—Historical. *J. Geol.* **4** (1905): 106–121. **Emerson.**
Geographic Influences in the Atlanta Campaign. By F. V. Emerson. *Maps and Illustrations.*

United States—Historical. *Science* **21** (1905): 863–867. **Thomas and Hewitt.**
Xuala and Guaxule. By C. Thomas and J. N. B. Hewitt.
Discusses the location of these villages, touched at by De Soto on his famous expedition.

United States—Mines. ———
Bureau of the Census. Bulletin 9. Mines and Quarries. Washington, 1904. Size 11½ × 9, pp. 60.

United States—Nevada. *J. Franklin I.* **160** (1905): 1–20. **Spurr.**
Tonopah Mining District. By J. E. Spurr. *With Map.*

United States—New York. *B. Geolog. S. America* **15** (1904): 449–460. **Dryer.**
Finger Lake Region of Western New York. By C. R. Dryer. *With Map and Illustrations.*

United States—New York. *B. Geolog. S. America* **16** (1905): 215–228. **Tarr.**
Moraines of the Seneca and Cayuga Lake Valleys. By R. S. Tarr. *With Map and Diagram.*

United States—Pennsylvania. *B. American G.S.* **37** (1905): 145–154. **Tower.**
Topography and Travel in Pennsylvania. By W. S. Tower.

United States—Population. ———
Bureau of the Census. Bulletin 7. Estimates of Population of the larger Cities of the United States in 1901, 1902, 1903. Washington, 1904. Size 11½ × 9, pp. 22.

United States—Surveys. ———
Dep. of Commerce and Labor. Coast and Geodetic Survey. No. 1. The Coast and Geodetic Survey (pp. 6); No. 2. Triangulation and Reconnaissance (pp. 4, *plate*); No. 3. Base Apparatus (pp. 10, *plate*); No. 4. Time, Latitude, Longitude, and Azimuth (pp. 4); No. 5. Terrestrial Magnetism (pp. 4, *map*); No. 6. Hydrography (pp. 4, *plate*); No. 7. Topography (pp. 4, *plate*); No. 8. Tides and Tidal Currents (pp. 4); No. 9. Leveling (pp. 4, *plate*); No. 10. Coast Pilots (pp. 4); No. 11. Chart Publications (pp. 4); No. 12. Gravity (pp. 4, *plate*); No. 13. Geodesy or Measurement of the Earth (pp. 6). Washington, 1904. Size 7½ × 5.

United States—Tennessee. *J. Geol.* **13** (1905): 194–231. **Johnson.**
The Tertiary History of the Tennessee River. By Douglas Wilson Johnson. *Map and Sections.*
See note in Monthly Record for October (p. 455).

United States—Wisconsin and Minnesota. *J. Geol.* **13** (1905): 238–256. **Chamberlin.**
The Glacial Features of the St. Croix Dalles Region. By Rollin T. Chamberlin. *With Maps.*

CENTRAL AND SOUTH AMERICA.

Brasil—Historical. ———

The Dutch on the Amazon and Negro in the Seventeenth Century. London, [*not dated*]. Size 13½ × 8½, pp. 28. *Presented by the Foreign Office.*

British Guiana and Brasil—Historical. ———

Note as to the Bearing of the Alliances of Portugal and Holland on the Boundary Question (pp. 8). Note as to the Bearing of the Alliances of Portugal and Great Britain on the Boundary Question (pp. 6). Note on the Treaty of Amiens with reference to the Boundary Question (pp. 4). Note on Christovão Ayres Botelho. (pp. 6). [*Not dated.*] Size 13½ × 8½. *Presented by the Foreign Office.*

British Honduras. *P.S. Antiquaries* **20** (1903-4): 27-32. **Gann.**

Report of a visit to the ruins on the Colombia branch of the Rio Grande. By Dr. T. Gann.

Central America—Anthropology. **Sapper.**
Archiv. für Rassen- u. G. Biologie **2** (1905): 383-412.

Die Zukunft der mittelamerikanischen Indianerstämme. Von Karl Sapper.

Chile—Meteorology. **Marabini.**

Observatorio Meteorológico del Colegio Salesiano "S. José" . . . Resúmen de las Observaciones de quince años (1888-1902) . . . Por P. Marabini. Plate Iª. Santiago, 1904. Size 10 × 7, pp. 56.

Dutch Guiana. *Deutsch. Rundschau G.* **27** (1905): 394-398. **Rehwagen.**

Das heutige Surinam. Von A. Rehwagen. *With Map and Illustrations.*

Guatemala. *An. Museo Nac. San Salvador* 1 (1905): 551-558. **Rodrigues.**

El volcan de Agua y la inundación de la Ciudad de Guatemala en el año 1541. Dr. J. J. Rodríguez L.

Guatemala—Seismology. *P.R.S.* **76** (Ser. A) (1905): 102-111. **Oldham.**

The Rate of Transmission of the Guatemala Earthquake, April 19, 1902. By R. D. Oldham.

Paraguay—Historical. *Z. Kolonialpolitik* **7** (1905): 346-361. **Canstatt.**

Der Jesuitenstaat in Paraguay. Von O. Canstatt.

Peru. *XX.-XXIII. Jahresb.* (1901-4) *Württemberg. V. Handelsg.* (1905): 27-55. **Debach.**

Reiseeindrücke aus dem Departemento Ancachs, Perú. Von H. Debach.

Peru. *B. Ministerio Fomento* **1**, No. 10 (1903): 33-80. **Robledo.**

El Bajo Urubamba. Por L. M. Robledo.

Peru—Andes. *B.S.G. Lima* **15** (1904): 173-178. **Enock.**

El "Huascaran." Apuntes sobré su última ascensión. Por C. Reginald Enock.

Peru—Madre de Dios. ———

Nuevas Exploraciones en la Hoya del Madre de Dios. Publicación de la Junta de Viás Fluviales. Lima, 1904. Size 13 × 9, pp. xxviii. and 186. *Maps and Illustrations.*

Contains large-scale maps of portions of the Tambopata and neighbouring rivers.

Peru—Surveys. **La Combe, Von Hassel, and Pesce.**

El Istmo de Fiscarrald. Informes de los Señores La Combe, Von Hassel, y Pesce. Publicación de la Junta de Vias Fluviales. Lima, 1904. Size 13 × 9, pp. vi. and 230. *Maps and Illustrations.*

Further results of the expeditions organized by the Junta in 1901 and following years (cf. *Journal*, vol. **23**, p. 604 *et seq.*).

South America. *B.S. d'Études Colon.* **12** (1905): 277-307. **Jottrand.**

Des Andes au Para. Par V. Jottrand. *With Illustrations.*

AUSTRALASIA AND PACIFIC ISLANDS.

Friendly Islands. **Hunter.**

Trade of the Friendly Islands, 1902-04. Foreign Office, Annual No. 3406. London, 1905. Size 9½ × 6, pp. 14. *Price* 1*d.*

German New Guinea. **Hahl.**
XX.-XXIII. Jahresb. (1901-4) *Württemberg V. Handelsg.* (1905): 56-75.

Zur Geographie des Schutzgebietes von Deutsch-Neu-Guinea. Von Dr. A. Hahl.

Marianne Islands—Guam. *National G. Mag.* 16 (1905): 229–237. **Safford.**
Our Smallest Possession—Guam. By W. E. Safford. *With Illustrations.*

New South Wales. **Jaquet, Card, and Harper.**
Records Geolog. Surv. New South Wales 8 (1905): 1–66.
The Geology of the Kiama-Jamberoo District. By J. B. Jaquet, G. W. Card, and L. F. Harper. *With Map and Illustrations.*

New Zealand. **Marshall.**
The Geography of New Zealand—Historical, Physical, Political, and Commercial. By Dr. P. Marshall. With Contributions by Prof. J. W. Gregory, A. Hamilton, and G. Hogben. Christchurch, N.Z., etc.: Whitcombe and Tombs, [*not dated*]. Size 7½ × 5, pp. x. and 402. *Maps and Illustrations. Price 4s. 6d. net. Presented by the Publishers.*

The subject appears to be treated in a thoroughly scientific manner, with full knowledge of the recent developments in geographical methods.

Pacific Ocean—Pitcairn Island. **Simons.**
Pitcairn Island. Report by Mr. R. T. Simons. Colonial Reports, Miscellaneous, No. 30. Size 9½ × 6, pp. 12. *Price 1d.*
See note in Monthly Record for October (p. 456).

Queensland. *Queensland Govt. Mining J.* 6 (1905): 112–117. **Ball.**
Sapphire Fields of Central Queensland. Notes on their present condition. By Lionel C. Ball. *Illustrations.*

Victoria. *Petermanns M.* 51 (1905): 118–119. **Lendenfeld.**
Die heissen Winde in Melbourne. Von R. von Lendenfeld.

POLAR REGIONS.

Antarctic. **Scott.**
The Voyage of the *Discovery*. By Captain R. F. Scott. 2 vols. London: Smith, Elder & Co., 1905. Pp. (vol. i.) xx. and 556; (vol. ii.) xii. and 508. *Maps and Illustrations. Price 42s. net. Presented by the Publishers.* [To be reviewed.]

Antarctic. *Nature* 72 (1905): 244–245. **Hutton.**
Ancient Antarctica. By F. W. Hutton.

Antarctic. *La Nature* 33 (1905): 291–294. **Martel.**
A quoi servent les explorations antarctiques. Par E. A. Martel. *With Illustrations.*

Antarctic. *P.R.S., Ser. A.* 76 (1905): 284–295. **Milne.**
Preliminary Notes on Observations made with a Horizontal Pendulum in the Antarctic Regions. By J. Milne, F.R.S.

The observations were made by Mr. Bernacchi during the British Antarctic Expedition.

Antarctic. *Scottish G. Mag.* 21 (1905): 323–328. **Mossman.**
The Recent Voyage of the *Uruguay*. By R. C. Mossman. *With Chart and Illustrations.*

Antarctic—Meteorology. *Symons' Meteorolog. Mag.* 40 (1905): 86–89. **Mossman.**
The Antarctic Meteorological Station in the South Orkneys. By R. C. Mossman. *With Illustrations.*

Antarctic—Palæontology. **Wiman.**
Vorläufige Mitteilung über die alttertiären Vertebraten der Seymourinsel. Von Carl Wiman. (From *Bulletin of the Geol. Instit. of Upsala*, vol. 6.) Upsala, 1905. Size 9½ × 6½, pp. (6). *Plate.*

Antarctic—Rocks. *B. Geolog. I. University Upsala* 6 (1902–03): 234–246. **Nordenskjöld.**
Petrographische Untersuchungen aus dem westantarktischen Gebiete. Vorläufige mitteilung von O. Nordenskjöld. *With Maps. Also separate copy.*

Antarctic—Scottish Expedition. *Scottish G. Mag.* 21 (1905): 322–323. **Bruce.**
Scottish National Antarctic Expedition. Outline Map of Laurie Island, South Orkneys, 1903. By W. S. Bruce. *With Map.*

British Expedition—The "Discovery." **Smith.**
On the design of the Antarctic Exploration Vessel *Discovery*. By W. E. Smith, C.B. 1905. Size 11½ × 9, pp. 40. *Illustrations.*

MATHEMATICAL GEOGRAPHY.

Altitudes. *C. Rd.* 141 (1905): 153–155. **Teisserenc de Bort.**
Vérification des altitudes barométriques par le visée directe des ballons sondes. Note de L. Teisserenc de Bort.

Cartography. **Penck.**
Fortschritte in der Herstellung einer Erdkarte im Masstabe 1 : 1,000,000. Von Albrecht Penck. *With Map. Also separate copy, presented by the Author.*

Figure of the Earth. *Beiträge Geophysic* 7 (1905): 283–326. **Arldt.**
Die Gestalt der Erde. Von Dr. T. Arldt. *With Maps.*

Hydrography. *Nautical Mag.* 74 (1905): 611–622. ———
Uncharted Rocks in Well-used Trade Routes. *Illustration.*

Surveying. *M. Deutsch. Schutzgeb.* 18 (1905): 1–58. **Böhler and Kurtz.**
Beschreibung des Basismessverfahrens mittels horizontaler Distanzlatte. Von H. Böhler.
Ein bequemeres Rechenverfahren zur Böhlerschen Basismessung. Von Kapitän-Leutnant Kurtz.

Surveying. **Close.**
Text-Book of Topographical and Geographical Surveying. By Major C. F. Close, C.M.G. London: Wyman & Sons, 1905. Size 11 × 7½, pp. vi. and 288. *Maps and Diagrams. Price* 3*s.* 6*d. Presented by the Publishers.* [See reviews, *ante.*]

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geomorphology. *Science* 21 (1905): 825–828. **Davis.**
Leveling without basé-leveling. By Prof. W. M. Davis.

Shows how Dr. Passarge's investigations of African surface features tend towards a modification of current ideas.

Geomorphology. *Le Globe, B.S.G. Genève* 44 (1905): 125–128. **Pittard.**
Contribution à l'étude de la formation des gorges (Action des eaux tourbillonnantes). Communication de M. le prof. Eugène Pittard.

Geophysics. *M.V.E. Dresden* (1905): 39–53. **Reibisch.**
Ein Gestaltungsprinzip der Erde. II. Von Paul Reibisch. *Maps.*

A further elaboration of the author's theory which seeks to account for the major relief of the Earth's surface by a secular swinging motion of its mass.

Glacial Epoch. *Forh. Vidensk.-S. Christiania* (1904): No. 7, pp. 20. **Øyen.**
Versuch einer glacial geologischen Systematik. Von P. A. Øyen.

Glaciers. **Blümcke and Finsterwalder.**
Sitzber. math.-phys. Klasse K.B.A. W. München (1905): 109–131.
Zeitliche Änderungen in der Geschwindigkeit der Gletscherbewegung. Von A. Blümcke und S. Finsterwalder. *Diagram.*

Glaciers. *Appalachia* 11 (1905): 1–6. **Reid.**
The Flow of Glaciers and their Stratification. By Prof. H. F. Reid. *Plates.*

Hydrology. *Ciel et Terre* 26 (1905): 149–153. **Gerlier.**
Les puits qui soufflent et qui aspirent. Par Dr. F. Gerlier.

Phytogeography. **Unwin.**
Future Forest Trees, or the importance of the German experiments in the Introduction of North American Trees. By A. H. Unwin. London: T. Fisher Unwin, 1905. Size 8½ × 5½, pp. 108. *Illustrations. Price* 7*s.* 6*d. net. Presented by the Publisher.*

An interesting account of the results of planting, for the sake of their timber, various species of North American trees, which in this country are known chiefly as ornamental trees. In many cases the results have been very encouraging.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. *M.V.E. Dresden* (1905): 29–38. **Gravelius.**
Zur Anthropogeographie des Wassers. Von Prof. D. Gravelius. I. Einleitende Bemerkungen.

Commercial. **Brant.**
General Index, arranged in order of Countries and Subjects, to Hertslet's Commercial Treaties, vols. 1 to 21. Compiled by R. W. Brant. Vol. 22. London: Harrison & Sons, [1905]. Size 9 × 5½, pp. vi. and 1282. *Price* 15*s*.

Commercial. *Globus* 88 (1905): 1-4. **Eckert.**
Die Grossmächte und der Grossverkehr. Von Dr. M. Eckert. *With Map.*

The map shows graphically the relative importance of the great ocean trade-routes.

Commercial. **Kraus.**
Versuch einer Geschichte der Handels- und Wirtschaftsgeographie. Habilitationsschrift zur Erlangung der Venia legendi an der Akademie für Sozial- und Handelswissenschaften vorgelegt von Dr. A. Kraus. Frankfurt a. M.: J. D. Sauerländer, 1905. Size 9½ × 6, pp. viii. and 104. *Price* 2*m*. 40. *Presented by the Publisher.*

Historical. *B.S.G. Italiana* 6 (1905): 64-75. **Enrile.**
Di un atlante nautico disegnato in Messina nel 1596 da Giovanni Oliva e conservato oggi nella Biblioteca del Comune di Palermo. Communicazione del dott. A. Enrile. *With Map.*

Historical. *B.G. Hist. et Descriptive* (1904): 206-222. **Hamy.**
James Cook et Latouche-Tréville. Note sur un projet d'exploration des mers australes (1774-1775). Par le Dr. E. T. Hamy.

Reproduces correspondence relating to the project of a South sea voyage entertained by Latouche.

BIOGRAPHY.

Arrhenius. *Terrestrial Magnetism* 10 (1905): 50. ———
Svante August Arrhenius. *With Portrait.*

Bering. *G. Tidskrift* 6 (1882): 89-98. **Lauridsen.**
Vitus Jonassen Bering. Af P. Lauridsen. *With Map.*

Ratzel. *Riv. G. Italiana* 12 (1905): 8-18, 102-126. **Marinelli.**
Federico Ratzel e la sua opera geografica. Appunti di O. Marinelli.

Rein. *Veröffent.* 1 *G.V. Bonn* (1905): 1-8. **Kerp.**
Johannes Justus Rein zum 70. Geburtstage. Von H. Kerp. *With Portrait.*

Ricci. *Riv. G. Italiana* 12 (1905): 136-146. **Magnaghi.**
Il P. Matteo Ricci e la sua opera geografica sulla Cina. A. Magnaghi.

Richter. *Riv. G. Italiana* 12 (1905): 226-228. **Gravisi.**
Edoardo Richter.—Cenni biografici. Dott. G. Gravisi.

Richter. **Penck.**
Eduard Richter. Von A. Penck. Wien, 1905. Size 7 × 4½, pp. 10.

Ruge. *M.V.E. Dresden* (1905): 9-21. **Gravelius.**
Sophus Ruge. Von Prof. Dr. H. Gravelius.

Saussure. *Le Globe, B.S.G. Genève* 44 (1905): 143-157. **Claparède.**
Henri de Saussure (1829-1905). Par M. Arthur de Claparède. *Portrait.*

Stübel. *Riv. G. Italiana* 12 (1905): 81-91. **D'Ossat.**
Maurizio Alfonso Stübel, i suoi viaggi e la sua teoria dei vulcani. Di G. de Angelis D'Ossat. *With Portrait.*

Tippu Tib. *Deutsche Kolonialzeitung* 22 (1905): 291-292. **Leue.**
Tipputip. Von A. Leue. *Portrait.*

The famous Arab trader has lately died.

Van Langren—Bibliography. **Tiberghien.**
Contribution à la Bibliographie de M.-F. Van Langren. Documents existant à la Bibliothèque Royale de Belgique. Par Alb. Tiberghien. (Extrait de la 'Révue des Bibliotheques et Archives de Belgique,' tome 2.) 1904. Size 9 × 6, pp. 14. *Presented by the Author.*

Describes some of the cartographic productions of Van Langren which have hitherto received little notice.

Wissmann. *Mouvement G.* 22 (1905): cols. 307-309. **[Wauters.]**
Le Major von Wissmann. Par A. J. W. *Portrait.*

GENERAL.

Bibliography. [Brunner.]

Catalog der Bibliothek des Schweizer Alpenclub, 1905. Mit Sachregister. Zürich, 1905. Size 9 × 6, pp. 96. *Presented by Mr. H. Brunner.*

Bibliography. ———

International Catalogue of Scientific Literature. Third Annual Issue. J. Geography, Mathematical and Physical. London: Harrison & Sons, 1905. Size 8½ × 5½, pp. viii. and 360. *Price* 16*s*. 6*d*.

Current Events. **Almeida.**

Chronicas Geographicas. Estudos de actualidade por F. de Almeida. Coimbra: F. Amado, 1905. Size 7½ × 5, pp. xvi. and 254. *Presented by the Author.*

Educational. *The School World* 7 (1905), 100–103. **Simmonds and Richardson.**

Experimental Geography. II. Temperature Observations. By A. T. Simmonds and Hugh Richardson. *Diagrams.*

See note on first part in *Journal*, vol. 25, p. 219.

Educational. *J. of G.* 4 (1905): 145–163. **Tarr and others.**

Results to be expected from a School Course in Geography. By R. S. Tarr, R. H. Whitbeck, M. K. Genthe, and Mark S. W. Jefferson.

French Colonies. ———

Statistiques Coloniales pour l'Année 1903. Commerce. Melun, 1905. Size 9½ × 6½, pp. lxiv. and 1060.

Travel. **Macdonald.**

In Search of El Dorado, a Wanderer's Experiences. By A. Macdonald. With an Introduction by Admiral Moresby. London: T. Fisher Unwin, 1905. Size 9 × 6, pp. xviii. and 292. *Illustrations. Price* 10*s*. 6*d*. *net. Presented by the Publisher.*

A record of adventure in the wilds of the Yukon and Australia in search for gold. The letters F.R.G.S. are appended to the author's name, but he is not a member of our Society.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Denmark. **Danish General Staff.**

Generalstabens topografiske Kaart over Danmark. Scale 1 : 40,000 or 1·5 inch to a stat. mile. Sheets: Aakirkeby, Christiansö, Gjedser, Nexö, Rönne, Skjelby. Copenhagen: Danish General Staff, 1905. *Presented by the Danish Government.*

England and Wales. **Ordnance Survey.**

Ordnance Survey of England and Wales:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from September 1 to 30, 1905.

2 miles to 1 inch:—

Printed in colours, folded in cover or flat in sheets, 28, 29, 35, 43. *Price, on paper*, 1*s*.; *mounted on linen*, 1*s*. 6*d*. *each.*

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With hills in brown or black, 319, 334. 1*s*. *each* (engraved).
Printed in colours, folded in cover or flat in sheets, 218, 298. *Price, on paper*, 1*s*.; *mounted on linen*, 1*s*. 6*d*. *each.* 319 and 334 (combined). *Price, on paper*, 1*s*. 6*d*.; *mounted on linen*, 2*s*.

6-inch—County Maps (first revision):—

Brecknockshire, 4 N.E., 6 N.E., 10 S.W., S.E., 11 S.W., S.E., 15 S.E., 20 N.E., 21 N.W., N.E., S.W., S.E., 22 N.W., S.W., 26 N.W., S.W., S.E., 27 N.W., N.E., S.E., 28 N.W., S.E., 29 N.W., S.W., 32 N.E., S.W., S.E., 33 N.W., N.E., S.W., 35 N.W., 36 S.W., 38 N.E., S.W., S.E., 39 N.W., S.W., S.E., 40 N.E., S.W., S.E., 41 N.W., S.W., S.E., 42 N.W., 43 N.E., 44 N.W., N.E.,

45 N.E., S.W., 46 N.W., N.E., S.W., 47 N.W., 48 N.W. **Cardiganshire**, 28 N.E. **Devonshire**, 2 S.W., S.E., 4 S.W., 6 N.W., 8 N.E., S.W., 10 N.W., S.W. **Gloucestershire**, 1 S.W. **Herefordshire**, 9 S.W., 13 N.W., S.W., S.E., 21 N.E., 29 N.W., 42 N.W., 46 S.W. **Lincolnshire**, 95 S.W., 105 N.E., 115 N.W., N.E., 124 N.W., 132 N.E., S.E. **Norfolk**, 102 N.E., 103 S.E., 107 S.W. **Radnorshire**, 21 N.E. **Somerset**, 6 N.E. **Suffolk**, 12 N.E., S.W., 13 N.E., 14 S.E., 17 S.W., 18 S.E., 19 S.W., 26 N.E., 27 N.E., 32 N.W., 33 N.W. **Warwickshire**, 14 N.W., 24 S.W., 25 N.W., N.E., 26 N.W., 31 N.W., 33 N.W., 36 N.E., S.E., 43 S.W., 48 N.E. **Worcestershire**, 17 S.W., 24 N.W., 30 N.E., S.E., 36 S.W., 40 S.W., 42 N.E. **Yorkshire** (first revision of 1891 survey), CCLXXVIA., N.E., CCXCIII., N.W., N.E. (S.W. and S.E. and CCXCVIIIA., N.E.), CCXCV., S.E. 1*s. each.*

25-inch—County Maps (first revision):—

Cardiganshire, XXIII. 16; XXVI. 16; XXXI. 16; XXXII. 5, 9; XXXIII. 14, 15; XXXV. 9; XXXIX. 6, 10, 11, 12; XL. 2, 3, 4, 6, 7, 8, 9, 10, 12; XLI. 1, 2, 3, 5, 6, 7, 9, 10. **Carmarthenshire**, II. 9; VII. 3, 7, 10. **Devonshire**, XVII. 6, 10, 11, 12; XVIII. 9; XXV. 16; XXXV. 4; XLVIII. 15; LV. 13; LIX. 3, 4, 7, 8; LX. 1, 2, 5, 6, 9, 10, 13, 14, 15, 16; LXA. 13; LXXII. 2, 3, 4, 6, 7, 8, 11, 15; LXXIIA. 1; LXXXIX. 12; XC. 13; XCI. 13, 14, 15; XCII. 13, 14, 15, 16; XCIII. 13, 14; XCIX. 7; C. 1, 5, 9, 12, 13, 14, 15, 16; CI. 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 15, 16; CII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12; CIII. 1, 3, 5, 6, 7; CIX. 2, 3, 6, 7, 10; CX. 2, 4, 15. 3*s. each.* XXV. 15; XLVIIIA. 13, 14; LX. 11. 1*s.* 6*d. each.* **Lincolnshire**, LXXXVII. 5, 11, 16; LXXXVIII. 2, 3, 4, 5, 6, 8, 10, 11, 13, 14, 15, 16; LXXXIX. 1, 2, 4, 7; XC. 3, 4, 5, 6, 7, 8, 9; CI. 1, 2, 3, 4, 5, 6; CIX. 14; **Norfolk**, XLV. 9, 15; XLVI. 7; XLVII. 1, 2, 3, 5, 7, 9, 10, 11, 13, 14, 15; LIX. 10, 14; LXVIII. 2, 6, 10, 14; LXX. 4; LXXI. 1, 2, 3; LXXX. 2, 6, 11, 12; LXXXIX. 3, 7, 8, 11, 15, 16; XC. 14; XCIX. 2, 3, 4; C. 1, 2. **Suffolk**, III. 8; IV. 6, 7, 8, 10, 11, 12, 14, 15, 16; X. 2, 3, 7, 11. **Warwickshire**, XL. 7, 8, 14, 15; XLI. 4, 7, 10, 13; XLIII. 12, 16; XLIV. 1, 2, 3, 6, 8, 9, 10, 11, 12, 14, 15, 16; XLV. 7, 8, 14, 16; XLVI. 1, 6, 7, 10, 11, 12, 13, 14; XLVII. 1, 2; LI. 1, 3, 4, 8, 11, 12, 14, 15, 16; LII. 1, 2, 3, 5, 6, 12; LIV. 3, 7, 10, 11, 14, 15; LV. 1, 3; LVII. 2, 3, 9, 10, 13. **Yorkshire** (First Revision of 1891 Survey), CCLXXXVIII. 14; CCLXXXIX. 14. 3*s. each.*

England and Wales. **Geological Survey.**

1-inch—New Series (colour printed):—

141, Loughborough; 282, Devizes; 299, Winchester. Drift edition. 1*s.* 6*d. each.*

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Brecknockshire, 43 N.W., N.E., S.E., 44 S.W. **Carmarthenshire**, 49 S.E., 50 N.W. **Derbyshire**, 57 S.W., 60 N.W., N.E., S.E., 61 N.W. **Glamorganshire**, 2 S.E., 3 N.W., S.E., 4 S.W., 8 S.W., 9 N.W., N.E., S.W., S.E., 15 N.W., N.E., S.E., 34 N.W., N.E. **Leicestershire**, 15 N.E., S.E., 16 N.W., S.W., S.E., 22 S.E., 23 N.E., S.W., S.E., 29 N.E., 31 N.W., N.E., S.E., 37 N.E. **Staffordshire**, 41 S.W., 47*a* N.W. 1*s.* 6*d. each.*

(*E. Stanford, London Agent.*)

Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Karographischen Abteilung der Königlichen Preussische Landesaufnahme. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheets: (brown hills and contours) 313, Oschersleben; (plain) 318, Zossen. Berlin, 1905. *Price* 1.50 *mark each sheet.*

Germany. **Polis.**

Regenverteilung am 17 Juni 1904 im Maas-, Rhein- und Wesergebiet entworfen von P. Polis. Scale 1 : 1,250,000 or 19·7 stat. miles to an inch.—Gewitterverteilung am 17. Juni 1904 im Maas- und Rheingebiet entworfen von P. Polis. Scale 1 : 1,250,000 or 19·7 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1905, Taf. 15. Gotha: Justus Perthes, 1905. ***Presented by the Publisher.***

London. **Stanford.**

Stanford's New Map of the County of London. Scale 1 : 15,840 or 4 inches to a stat. mile. 20 sheets. London: Edward Stanford, 1905. *Price, in sheets*, 15*s. Presented by the Publisher.*

Owing to recent important changes, it has become necessary to publish a new edition of this excellent map of London, and it is evident that the work of revision has been well done. The map extends to Barking and Cross Ness on the east, and includes the whole of the extra metropolitan borough of West Ham; on the west it embraces part of the borough of Ealing, the whole of the borough of Richmond, and the greater part of the borough of Kingston; on the north, part of the borough of

Hornsey; and on the south, the borough of Wimbledon and the hamlet of Penge, with the northern verge of Croydon. Altitudes in feet are given at frequent intervals, and the map is carefully printed in colours.

Montenegro. **Hassert.**

Tiefenkarten montenegrinischer Seen, aufgenommen im Jahre 1900. Von Kurt Hassert. *Petermanns Geographische Mitteilungen*, Jahrgang 1905, Taf. 16. Gotha: Justus Perthes, 1905. *Presented by the Publisher.*

Portugal. **Serviço do Estado Maior.**

Carta dos Arredores de Lisboa. Scale 1 : 20,000 or 3·2 inches to a stat. mile. Sheets: 8, 62, 63, 65, 67, 68, 71, 72, 73, 76, 77, 78, 80, 81, 82. Lisbon: Serviço do Estado Maior, 1903–1905.

ASIA.

Asia. **Philip.**

Philip's Comparative Series of Large Schoolroom Maps. Asia. Scale 1 : 6,000,000 or 94·7 stat. miles to an inch. London: George Philip & Son. *Price* 18*s*. *Presented by the Publisher.*

This large wall-map measures about 6½ × 5½ feet, and is drawn and printed in a bold style. In keeping with the rest of the series, it is orographically coloured, the lower lands being in two tints of green, and the higher three shades of brown. The mountain ranges are also shown by the ordinary shading beneath the orographical tinting. Instead of making use of two colours, it would have been preferable to have used only shades of brown. A small inset shows political divisions.

Asia Minor. **Kiepert.**

Karte von Kleinasien. Bearbeitet von Dr. Richard Kiepert. Scale 1 : 400,000 or 6·3 stat. miles to an inch. Sheet C. i., Smyrna. Berlin: Dietrich Reimer (Ernst Vohsen), 1905. *Price* 6 *marks.*

In addition to Smyrna and the country immediately to the south and south-east, this sheet includes the islands of Chios, Samos, Nicaria, Patmos, and others in the neighbourhood.

China. **K. Preuss. Landesaufnahme.**

Karte von Ost.-China. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheet: Canton. Berlin: Kartographische Abteilung der K. Preuss. Landesaufnahme, 1905. *Price* 1.50 *mark each sheet.*

Indian Government Surveys. **Surveyor-General of India.**

Indian and adjacent countries. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheets: 71, parts of Nepal and Tibet; 78, parts of Nepal, Sikkim, Tibet, Bhutan, Bengal, and Assam; 83 and 84, parts of Bengal, Assam, and Burma; 91, parts of Assam, Tibet, and China (Yunnan and Se-chuan Provinces); 93, parts of Burma, China, and Siam; 101, part of China (Yunnan, Se-chuan, and Kweichou Provinces); 102, parts of Burma, Siam, Tongking, and China (Yunnan Province), 1903–4.—Northern Frontier, 4 miles to an inch. Sheets: 9 N.E., S.W., S.E., 15 N.E., 21 S.W., 22 N.W., N.E., S.E. Tibet, Season 1904–5.—North-Eastern Frontier, 4 miles to an inch. Sheets: 6 N.W., N.E., S.W., S.E., 7 N.W., Tibet, Season 1904–5. Calcutta: Survey of India Office. *Presented by the Surveyor-General of India.*

AFRICA.

Rhodesia, North-East. **Topographical Section, General Staff.**

North-east Rhodesia. Scale 1 : 2,000,000 or 31·6 stat. miles to an inch. London: Topographical Section, General Staff, War Office, 1905. *Price* 2*s*. *Presented by the Director of Military Operations.*

Togo. **Sprigade.**

Karte von Togo. Bearbeitet von P. Sprigade. Scale 1 : 200,000 or 3·1 stat. miles to an inch. Sheet C 2, Sokodé. Berlin: Dietrich Reimer (Ernst Vohsen), 1905. *Presented by Herr P. Sprigade.*

AMERICA.

Argentine Republic—Cordoba. **Río and Achával.**

Geografía de la Provincia de Córdoba, por Manuel E. Río y Luis Achával. Atlas. Buenos Aires: Compañía Sud-Americana de Billetes de Banco, 1905. *Presented by the Publisher.*

This large atlas contains altogether nine sheets of maps and sections and six sheets of illustrations. First is a general map of the province of Córdoba, next a hypsometrical map of the province showing zones of attitude from 76 to 2880 metres in different colours, followed by numerous vertical sections across the province. Then there are maps illustrating the hydrography and river systems, the geology, plant distribution, climate and means of communication. Of the illustrations, two sheets show varieties of plant life, while the others are of a general, industrial and agricultural nature. The atlas is published under the direction of the governor of the Córdoba, and if the maps are not all excellent specimens of cartography, the information contained is valuable.

Canada. **Department of the Interior.**

Map of Manitoba, Saskatchewan, and Alberta. Scale 1 : 792,000 or 12·5 stat. miles to an inch. Special edition showing even-numbered sections finally disposed of. Corrected to May 1, 1905. Prepared under the direction of R. E. Young, D.L.S., Superintendent of Railway and Swamp Lands. 3 sheets. Ottawa: Department of the Interior, 1905. *Presented by James White, Esq., Geographer, Department of the Interior, Canada.*

Canada. **Department of the Interior.**

Standard Topographical Map of Canada. Scale 1 : 500,000 or 7·9 stat. miles to an inch. Sheet 13, New Brunswick, St. John. Ottawa: Department of the Interior, 1905. *Presented by James White, Esq., Geographer, Department of the Interior, Canada.*

Canada. **Surveyor-General of Canada.**

Sectional map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Yale Sheet (11), West of Sixth Meridian, revised to August 10, 1905; Sicamous Sheet (112), West of Sixth Meridian, revised to August 10, 1905; Touchwood Sheet (169), West of Second Meridian, revised to August 18, 1905; Nut Mountain Sheet (169), West of Second Meridian, revised to August 18, 1905. Ottawa: Department of the Interior, 1905. *Presented by the Department of the Interior, Ottawa.*

Chile—Argentine Boundary. **Oficina de Limites, Santiago.**

Comision Chilena de Limites. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheets: Coquimbo-Aconcagua; Aconcagua; Aconcagua;—Santiago; O'Higgins-Colchagua; Llanquihue. Santiago: Oficina de Limites, [1905]. *Presented by the Oficina de Limites, Santiago.*

This important map shows the general cartographical results of the surveys of the Chilian Boundary Commission along the main range of the Andes from lat. 31° to 35° S., and from 42° to 43° S. There are altogether five sheets, each of which includes a degree of latitude and about a degree of longitude. Two editions of each sheet have been published, one showing the traverses and triangulation upon which the map is based, and the other the topographical features. As explained by Dr. Steffen in a paper read before our Society, owing to the nature of the country it was found more convenient to carry on the survey by a series of polygonal traverses combined with triangulation, than by a regular system of triangulation alone, and this arrangement is clearly shown on the sheets. The sheet containing Aconcagua is worthy of special attention, and it is interesting to note that the height of this peak is given as 6960 metres (or 22,835 feet) instead of 23,080 feet as shown in Mr. Fitzgerald's map in the *Geographical Journal* for November, 1898. Both Mr. Fitzgerald and Mr. Vines, who accompanied him, gave special attention and care to the fixing of the height of this peak. This Aconcagua sheet might have been rendered more complete as regards topographical detail if better use had been made of the surveys of Messrs. Fitzgerald and Vines. The international boundary, as determined by the recent arbitration, is laid down on the map in red.

North America. **Bartholomew.**

Reduced Survey Map of the United States and part of Canada, by J. G. Bartholomew, F.R.G.S. Scale 1 : 5,000,000 or 79 stat. miles to an inch. Edinburgh: John Bartholomew & Co., [1905]. *Price, mounted on cloth, 3s. net. Presented by the Publisher.*

A good and clearly drawn general map of the United States and the greater part of the Dominion of Canada, with eight inset plans of cities and towns. Only an indication of mountain ranges is given by form lines, with heights of peaks in figures, and consequently the names on the map, even in the more crowded parts, can be read with the greatest ease. This system is far preferable in a map of this character to attempting a great deal of shading, which only tends to obscure the lettering.

CHARTS.

Chile. **Chilian Hydrographic Office.**

Chilian Hydrographic Charts. Nos.: 109, Magallanes. Canal Fitz-Roy; 112, Magallanes, Puertos en el Golfo Xaultegua; (Provisional) 122, Seno Ultima Esperanza, Canal Señoret i Estero Eberhardt. Valparaiso; Oficina Hidrografica, Marine de Chile, 1905. *Presented by the Chilian Hydrographic Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for September and October, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for September and October, 1905. London: Meteorological Office, 1905. *Price 6d. Presented by the Meteorological Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for October, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

Russian Charts. **Chief Hydrographic Department, St. Petersburg.**

No.

655 Plan of Dickson Island and anchorage. Siberia. Scale 3500 feet to an inch. 1905.

659 Chart of Shuya River entrance and Shuya River to Shuya village. White Sea. Scale 1750 feet to an inch. 1905.

Presented by the Chief Hydrographic Department, Ministry of Marine, St. Petersburg.

PHOTOGRAPHS.

Arabia. ——

Four photographs of Mecca. *Presented by Lieut.-Colonel F. R. Maunsell, C.M.G., R.A.*

These photographs are of more than ordinary interest, and the fourth—a good general view of the city—is perhaps unique.

(1) Praying round the Kaaba, Mecca; (2) Closer view of the Kaaba; (3) Scene round Mount Arafat; (4) General view of Mecca and the Central Mosque.

Bahr-el-Ghazal. **Talbot.**

Eighteen photographs of the Bahr-el-Ghazal Region, taken by Colonel Hon. M. G. Talbot, R.E., C.M.G. *Presented by Colonel Hon. M. G. Talbot, R.E., C.M.G.*

The following are the titles of this interesting little typical set of photographs:—

(1) View near Kiro; (2) Officers at Kiro; (3) Kiro mess-house; (4) Director of Public Works at Dem Temma, near Fashoda; (5) Nassr. Audal, Sultan of Talgaona; (6) Golo girls; (7) Golo woman; (8) Woman travelling at the Bahr-el-Ghazal; (9) Store-house at Chak-Chak; (10) A Dinka hut near Chak-Chak; (11) Mess-house at Lado; (12) Kenissa; (13) Government house, Wau; (14) The Biri river; (15) View near Gondokoro; (16) A Bongo warrior; (17) Om Doku people; (18) One of Tambura's men.

Baltistan. **Duncan.**

Six photographs of Rock Carvings in the Indus and Shayok Valleys, taken by Miss Duncan. *Presented by Miss Duncan.*

These photographs were taken by Miss Duncan during her visit in the summer of 1904. The carvings are rough representations of animals, men, the human hand, and various other figures, together with hieroglyphics and writing, which, up to the present time, have not been deciphered, but which are supposed to date back at least five hundred years.

(1-5) Carvings on a rock in the Shayok Valley, near Kuness; (6) Carvings on rocks near Dumkar.

Nile Sudd. **D[illegible]**

Sixteen photographs of the Nile Sudd, taken by W. B. Drury, [illegible] *W. B. Drury, Esq.*

A good idea of the enormous accumulation of sudd in the tr[illegible] Nile can be obtained from these photographs, some of which, suc[illegible] decidedly typical. Mr. Drury has had considerable experience of sudd clearin having spent two years at the work. The titles are as follows:—

(1 and 2) Clearing the Bahr Jur; (3) Belgian commandant's house, Lado; (Bringing in fuel, Keniasa; (5) The bank of the Bahr-el-Jebel; (6) A camp at No. block, Bahr-el-Jebel; (7) A detached piece of sudd being towed away, Bahr-el-Jebe (8) Block No. 19, as it appeared before starting work; (9) Finishing off No. 16 bloc Bahr-el-Jebel; (10) Island, Bahr Jur; (11) Pulling the sudd out of the centre of tl channel; (12) Camp at the Bahr-el-Arab; (13) A village on the upper Nile; (1 Meat for the prisoners; (15 and 16) The Ripon falls.

Rhodesia. **Walla**

One hundred and sixty-three photographs of North-East Rhodesia and the Zambezi River, taken by L. A. Wallace, Esq. *Presented by L. A. Wallace, Esq.*

A most excellent series of photographs remarkably well taken and typical of t country. Many are enlargements, and these are specially effective. Mr. Wallace h had many years' experience of this part of Africa, during which he has evidently ma good use of his opportunities of photography. The following are the titles:—

(1 and 2) Lake Chila, Abercorn; (3) View on Tanganyika plateau; (4 and 5) Vie from Ilonda hill, Tanganyika; (6) View from Zumbe hill; (7) Mwaruli, the buryin place of Awemba chiefs; (8 and 9) South end of Lake Tanganyika; (10) Muching mountains, near Mirongo; (11) Strata of the Muchinga mountains; (12) Tempora village, Tanganyika plateau; (13) Lubu river, near Chambezi; (14) Chunanabu stream, Muchinga mountains; (15) Kachinga stream, Muchinga mountains; (16) stagnant pool on Tanganyika plateau; (17) View from Muchinga mountains do Nkanka stream, near Mirongo; (18) Mwambwa river; (19) Lufira river; (20) Luang river; (21) Hot springs, Nawalia; (22) Granite hill; (23) View from Granite hil (24 and 25) The lower Zambezi; (26) The Zambezi near Boroma; (27) Tete fro left bank of Zambezi; (28) Luiya river; (29) In Kabrabasa rapids, Zambezi rive (30) Top of Granite hill; (31 and 32) Kafue river; (33) Lake near Kafue river; (3 Chirangwa; (35 and 36) Upper Kafue river; (37 and 38) Near Chongolos on tl Luapula river; (39 and 40) South end of Lake Bangweulu; (41) Dry stream-bed Mlilo's, upper Luangwa valley; (42) Mlilo's village; (43) Baobab tree, Luang valley; (44) Village, upper Luangwa; (45 and 46) In upper Luangwa valley; (4 Limestone bed, Luumbu river; (48–51) Luumbu river; (52) View across the Luum valley; (53 and 54) Dry bush in Luumbu valley; (55) Spirit house at village; (5 Enclosed village, Luangwa valley; (57) Mambwe river; (58 and 59) Stream Luangwa; (60, 62, and 63) Luangwa river; (61) Hot pool, Luangwa; (64) Maki camp; (65) Granite hill; (66) Near top of Granite hill; (67 and 69) Granite hi (68) Road through bamboo jungle; (70 and 71) Granite hill on Tete road; (72, 7 76, 77, 110, and 111) Road from Fort Jameson to Tete; (74) Mount Chipiri; (7 Mount Chuuta; (78 and 79) Granite summit of Manji mount; (80–85) Kabraba rapids, Zambezi river; (86) Near foot of Kabrabasa rapids; (87 and 88) Kachimad stream; (89) Granite rock on Tete road; (90) Wart hog; (91–99) Luangwa rive (100) Mount Tendi in distance; (101) Chipawa station; (102–104) Upper Kaf river; (105–107) Forest on limestone, Kafue valley; (108) Suseufwa river; (10 Granite hill; (112) Making road; (113) Luapula flats near Chongolos; (114–11 Ferry at south end of Lake Bangweulu; (117–119) Swamp near Luapula; (120–12 South bank of Lake Bangweulu; (123) Kafue river plain; (124, 130, and 131) Maki rush mats; (125 and 126) A cold morning; (127) Village, showing hut and gra store; (128) Resting at a village; (129) A quiet village; (132 and 133) Carav resting at a village; (134 and 135) A game of cards; (136) Bargaining for flour; (13 Filling a goatskin with flour just bought; (138–141) Natives at water-hole in ve dry country; (142 and 143) On the Tete—Fort Jameson road; (144) View near Msad river; (145) In the dry Luangwa valley; (146–149) On Lake Bangweulu; (150 a 151) Near the foot of the Kabrabasa rapids, Zambezi river; (152) Travelling down tl Luangwa; (153) On the march; (154 and 155) Dead hippopotamus; (156) Treele forest in the Luangwa valley; (157) Lake Chila, Abercorn; (158 and 159) Lukus river; (160) Chimanabui river; (161) Zambezi river above Tete; (162 and 16 Luangwa river

N.B.—It would greatly add to the value of the collection of Phot graphs which has been established in the Map Room, if all the Fellov of the Society who have taken photographs during their travels, wou forward copies of them to the Map Curator, by whom they will acknowledged. Should the donor have purchased the photographs, will be useful for reference if the name of the photographer and h address are given.

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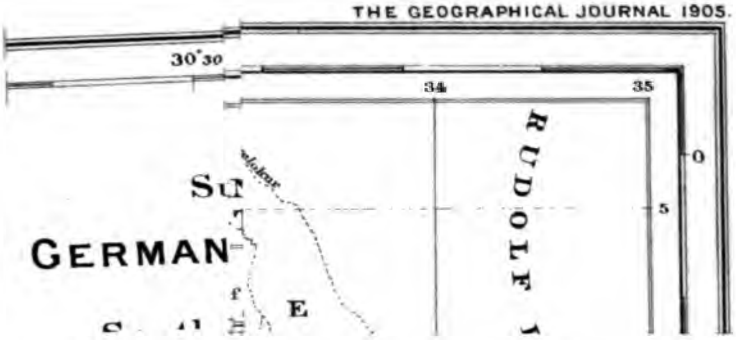
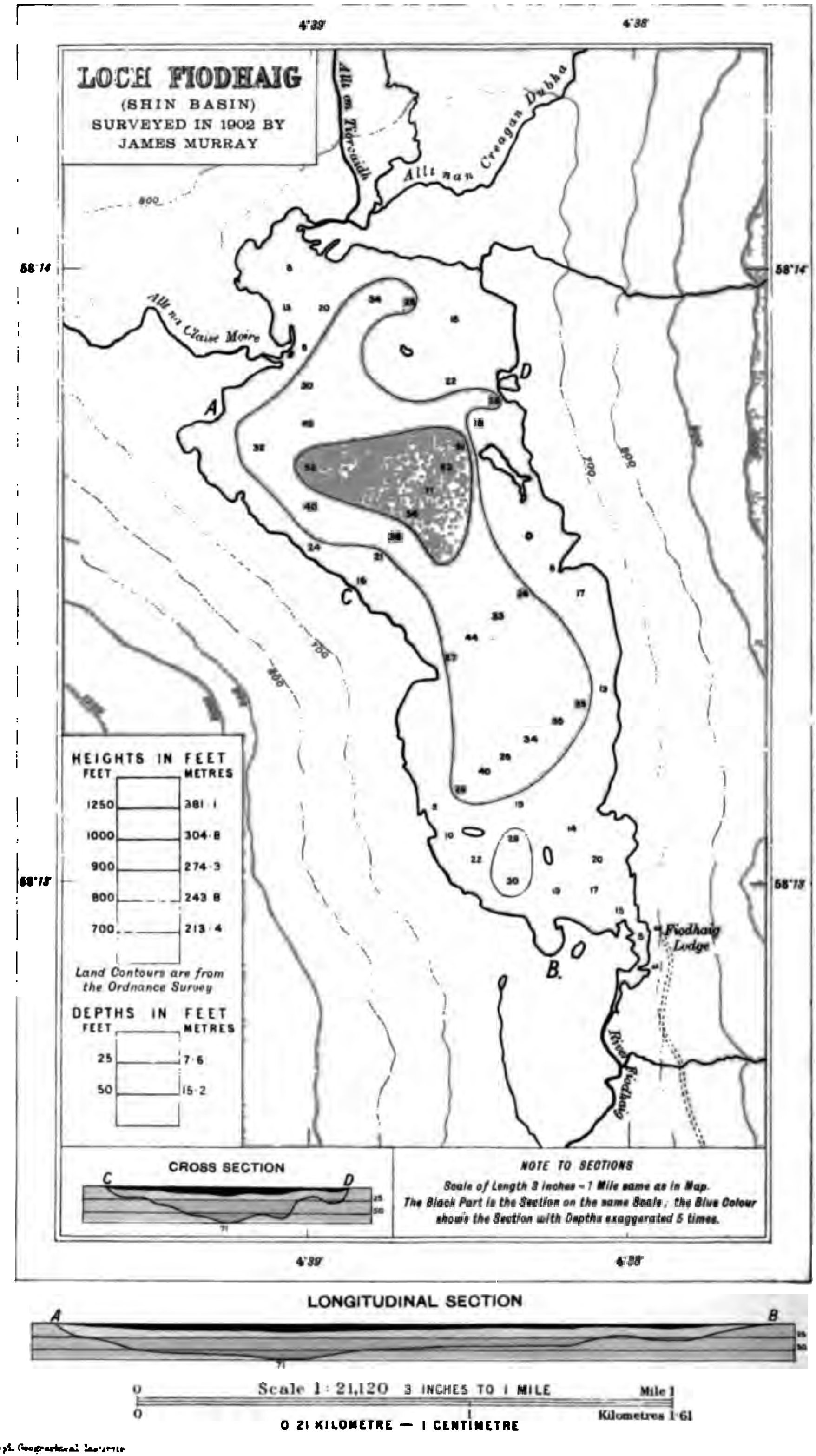
THE GEOGRAPHICAL JOURNAL 1905.



BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLANI

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



The Edinburgh Geographical Institute

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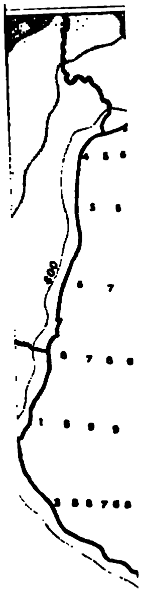

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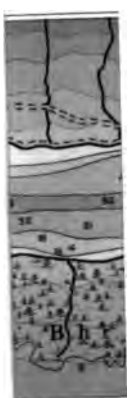

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THE SPHERE AND USES OF GEOGRAPHY.*

By Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S.

On the occasion of the commencement of the term, during which a system of geographical instruction will be continued on a more complete scale, it has been thought that an address of an introductory character may be useful. It is, I assume, well known at Cambridge that by the aid of funds supplied by the University and the Geographical Society, the means of studying several branches of the science of geography have been offered. There will be courses of lectures and instruction in surveying and map-making, in physical geography, in regional geography, in ethnology, and in the history of geography and of discovery.

The great importance of geography in almost every career is being felt more and more, for it is brought home to us in two ways, both by the advantages of a knowledge of where we are, of our environment, and of the ability to solve such questions as (1) *Where is it?* (2) *What is it?* (3) *How is it?* (4) *When was it?* applied to all parts of the world, on the one hand, and by a contemplation of the disastrous consequences of ignorance on the other. Geographical ignorance, speaking of geography in its broadest sense, is the cause of loss in commerce, of disaster in war, and of blunders in administration. Until merchants, soldiers, seamen, engineers, lawyers, and, above all, statesmen are also geographers, these evils will continue. Very few of them are geographers, in the true sense, now. I cannot doubt that such considerations will commend themselves to men at Cambridge who are engaged in choosing a profession, or who are actually entering upon a career.

* Address on the opening of the new term of the School of Geography at Cambridge, October 19, 1905.

Geography is the mother of all sciences, and is still indispensable to most sciences. The history of its study goes back for two thousand years. The astronomy of the ancients was mathematical geography, and nothing more. Geology became a science in the end of the eighteenth century. It extended a knowledge of physical geography over pre-historic times. Geology and geography overlap each other; and the true distinction seems to be that the geographer contemplates the present in the light of the changes that have taken place in the past, while the geologist studies the past in the light of the changes that are taking place in the present. History, as we all know, is another science which must be alike halt and blind without the aid of geography.

The study of geography is a discipline, and it is full of interest. It is a study that may be largely helped by imagination, by an acquaintance with the gradual progress of its several departments, and with the life-stories of those who have worked for it in times past, and by whose mighty efforts we now profit. It is from this point of view that I hope to set some of my auditors thinking, and thus to create an interest in geographical studies and geographical research. Then I cannot doubt that a conviction of the importance of such knowledge will be brought home to them, in whatever career they may select for themselves.

The foundation and basis of geography is the work of surveying and of map-making. Such work is attractive, because a great part of it must be done in the field, and because it carries us back in imagination to its gradual development, and to thoughts of what we owe to those who have gone before us. While we are working with theodolites and sextants exquisitely graduated by machinery, our thoughts ought to go back to the great men of old who turned out work almost as good as ours without those aids. Our curiosity should be aroused, and we should seek to know with what means they achieved their successes, and in what way their appliances were developed and improved until we became the inheritors of their labours and discoveries.

Think of the Grecian seaman Pytheas, how he fixed his point of departure at Massilia before he started on the discovery of this island of ours. By the use of a gnomon divided into 120 parts, and by observing its shadow at noon on the day of the solstice, he calculated the latitude of the place, and, when the correction for sun's semi-diameter is applied, the result is almost exactly the latitude of the Marseilles observatory. This was in the time of Alexander the Great, even before the days of Eratosthenes and Hipparchus, and centuries before those of Ptolemy and Strabo.

In those days it was only by deep thought, long and patient practice, and careful training that such results were obtained. It is all easy enough now. But we should revere the labours of our predecessors, and a study of their splendid work must, I think, very much increase the interest we take in our own studies. There is one point which I should wish particularly to impress upon you. The use of instruments in the field, and of methods of calculation and projecting in map-making, has a strong tendency to foster accuracy and to develop inventive talent. For instance, the astrolabe, an instrument which is said to have been used from hoar antiquity in observatories, was useless in the field until Martin Behaim invented the improvements. Still it was difficult to use, because it was necessary for one observer to hold it by a ring so that it might always be at right angles with the horizon, while another observer worked the sights. These difficulties, incidental alike to the astrolabe and the ancient form of quadrant, were avoided by the use of the *balestilla*, or cross-staff, first described by Werner of Nuremburg in 1514. Subsequent progress in the construction of instruments was clearly the result of inventive talent brought out by the practical experience of the requirements of surveying—whether by sea or land, the result is the same, aided by previous study. But an armchair geographer is not much good without practical experience in the field. We see this, in a most striking way, by comparing the mediæval maps of the workers in the study with those of the practical workers in the field. The editions of Ptolemy, with additions, were brought out by learned geographers between 1472 and 1572. There were thirty-three of them, but not one of them showed much improvement in the delineation of the Mediterranean coasts. It was most erroneous. Yet at the very same time the men of action were producing *Portolani* with most accurate delineations of the coasts of the Mediterranean. Such were the productions of the Freducci of Ancona, and others, whose direct successors were Waghenaer and the other Dutch draughtsmen of the Spiegeler.

I think this is very striking. It is by work in the field that true geographers are made and that inventive talent is developed. The famous author of the "Dell' Arcano del Mare," Sir Robert Dudley, had a sound knowledge of the previous history of his science, and of its theory, but it was his subsequent practical experiences which led him to invent those improvements in the astrolabe, which may still be seen in the "Tribuna di Galileo" at Florence. Then, again, it was not until Dr. Hues had made his voyage to Magellan's strait, and knew the needs of the surveyor by practical experience, that he composed his 'Tractatus de Globis et eorum usu,' which enables us and enabled our predecessors to realize the number of problems which could be solved by the use of the globe in spherical trigonometry, previous to the discovery of logarithms.

But let us confine our outlook to the inventive work of Cambridge men. It is well known that Gerard Mercator constructed a map of the world on a new projection, which had several advantages, especially in navigation. It is now in the national library at Paris. But he gave no account of the principle on which his projection was based, and consequently it was of no practical utility until this principle was discovered by another. Mercator drew his map in 1569, but it was not until 1594 that Edward Wright, the Cambridge tutor, discovered the true method of dividing the meridian, and that his table of meridional parts was published. Wright would never have done this if he had never moved from Cambridge. It was due to the voyage against the Spaniards with the Earl of Cumberland, five years before, that he was able to apply the test of experience to his theories, and to see for himself of what surveyors were most in need. This led him to turn his attention to the improvement of the charts then in use, and to the correction of grave errors and absurdities. Thus Wright's great service to navigation is directly due to his acquisition of practical experience at sea.

Time will not allow of my dwelling on any more examples of the same kind, but I must allude to the invention of a living Cambridge man, now an Honorary Fellow of Jesus College. The practice of his work as an observer resulted in the invention of an instrument to facilitate the computation of time from the usual sights taken for that purpose, and also to act as a check on errors when the time has been computed in the ordinary manner. It is a most ingenious invention for solving triangles, and, geometrically, it is absolutely correct.

The history of surveying and of map-making, and the way in which the pursuit has, in all ages, developed inventive talent, give it very special interest, though it is its utility in every calling and profession that must be the main inducement to join the surveying course. An instance of the danger of ignorance is the best way of impressing the importance of knowledge on our minds.

It was essential to the interests of this country and of the natives of another country that, in settling a boundary, a certain region should be kept within the British frontier. The matter came before a former prime minister, who, seeing that a meridian line on a map appeared to bring the region in question within the British frontier, decided that this imaginary line should form the boundary. He did not inquire whether the line was correctly placed on the map, nor did he consider whether the country had been surveyed. He thought it was all right because it was on the map, just as the old woman thought a story was true because it was in print. When the country came to be surveyed, it was found that the chosen meridian did not give us the required region; and much injury and embarrassment are the consequences. Now, no future prime minister, who has gone through a course of surveying and map-making with Mr. Hinks, could be guilty of such a blunder as this. The utility of a study is well shown by the disastrous results of an ignorance of it.

I believe that the course is to include geodesy and the methods used in a trigonometrical survey. This is a more advanced part of the course, and one that should be followed up by all who have the time to spare. Without geodesy there would be no exact measurements, no precision—advantages which are necessary for a cadastral survey, for a geological survey, and for engineering work. The history of these geodetical surveys is most fascinating. There is only time to mention the great Trigonometrical Survey of India, which I consider to be the grandest piece of geographical work ever achieved on this Earth—whether we regard its excellence, or the great difficulties and dangers which had to be overcome. Its accuracy must impress most people. The great longitudinal series from the Himalayas to Bangalore, in Southern India, was measured by triangulation from base to base. The distance was also measured by astronomical observations. What was the difference of the result between these two methods, in measuring a distance of hundreds of miles? It was not a mile; it was not a quarter of a mile. It was a few feet.

Those who enter the course for surveying and map-making will do so with the object of obtaining knowledge of great interest, which will be useful in almost every line of life. But they will also find that the history of the study is full of interest, while those who advance to a course of geodesy will be fascinated by the exquisite accuracy of its results. At Cambridge there are special facilities for learning the history of surveying. In the library of Samuel Pepys, at Magdalen College, there is a splendid collection of books on nautical astronomy. At King's College there is an astrolabe. Eventually there should be a collection of instruments, maps, and books to illustrate the gradual advance of improvements from the time of Pytheas.

I have been led to dwell upon the surveying course because it is the base and foundation of geography; but the other courses are of almost equal importance and interest. When by our knowledge of surveying and map-making we are able to answer the question, "Where is it?" we pass on to further investigations with the object of solving the great problem of "What is it?" What are the characteristics, history, and distribution of typical land forms? And for the solution of this question, the course of lectures on geomorphology has been provided. Mountain systems, river courses and river basins, coastal belts, and the configuration of continents, will be explained by Dr. Marr. Mountain systems form a most engrossing study to many of us, and it is one which in these days can easily be entered upon: witness the crowds pouring into the Swiss Alps and the Norwegian and Scottish highlands every summer. But how much more useful and informing these visits are to those who have been trained to understand as well as to see! One of the most interesting studies relating to the principal mountain systems of the world includes all the phenomena of glaciation, the formation of ice-fields, and the nature and movements of glaciers. It is only in Greenland and in the Antarctic Regions that the grandeur of the ice-fields can be fully appreciated, and the privilege of visiting these almost inaccessible and remote parts of the Earth is given to few. But the Alps and Norway offer opportunities for realizing in the field, on a smaller scale, what has been explained in the course of lectures. The effect of the weather, of climate on the physical aspects of a region, especially of a mountain region, are very important, and the Board of Geographical Studies hope to be able to offer a course of lectures on climatology during the next term. Nothing can be more striking than the effects of prevailing winds on the vegetation of mountain slopes, and consequently on the aspect of the mountains themselves, and on their outline.

In crossing the Cantabrian mountains from Oviedo to Leon, the traveller ascends a mountain-side richly clothed with woods of beech and chestnut. He crosses the summit, and he finds the other side rocky and arid and bare of trees. Equally striking is the effect of man's handiwork on the climatic conditions of a mountainous region. We know, for example, that the mountains rising from the vale of Murcia, in south-eastern Spain, once received abundant moisture, attracted by the forests which clothed it. We know it from the records of Jayme I. of Aragon and Alfonso X. of Castille. Now, owing to the destruction of those forests, the rainfall is so reduced that no soil covers the mountain-sides; all is bare rock, with a few olives here and there, with difficulty induced to grow on artificial terraces. These examples show that some knowledge of climatology is essential in the study of mountain systems.

The study of river courses and river basins is the next branch of geomorphology to which your attention will be invited. It is here that history and archæology come to the aid of geography. Rivers have wrought, and are now working, marvellous changes in the regions through which they flow. Take the Ganges as an example. In the earliest times the inhabited part of the Ganges valley was confined to the water-parting between the Jumna and the Sutlej. All the rest of the present valley of the Ganges was an arm of the sea. The vast region between Delhi and Calcutta has become inhabitable within the historical period. As dynasty succeeded dynasty, we find the foundation of cities recorded in situations lower and lower down the valley. The physical geographer compares the records of history with what he can now see with his own eyes. The process has been well described by Mr. Blanford. Standing on the banks of the Ganges, and watching the turbid flood swirling past, the observer sees the *chur* opposite, which the river left dry when its waters fell at the close of the last rainy season. Until lately it was covered with a rich crop of indigo. It is now more than half cut away, and buried beneath the waters. Huge masses detach themselves from time to time, and are swallowed up by the deep muddy stream. These are present facts. The inquirer then learns that half a century ago this branch of the river itself was only a moderate-sized *khall*, and that an old channel 7 or 8 miles off, and now little more than a string of pools, was at that time a great river. Turning to history, he will find that the ancient records of the people gradually unfold the causes and effects of what he has seen and heard. The positions of the capitals of the different dynasties which successively reigned in the valley, gradually moving down in the centuries until Calcutta was reached, illustrate the story of the great river valley. Thus its wonderful record is unfolded through the help of human testimony in perfect accord with the known principles of Nature's laws.

The history of the basins of the Indus, the Rhine, the Thames, the Humber reveal an analogous course of events, differing only in magnitude, and owing to variations in climate, and in the structure of each region.

Equally interesting and important is the study of changes in the sea-coasts, and this is a study which may lead to results of practical value. The present condition of the site on which Edward III. fought the great naval battle of Sluys has always appeared to me to be one of the most striking examples of those changes of which geomorphology takes cognizance. Then Sluys was a seaport on the shores of a bay open to the ocean. Now it is an inland market town, surrounded by pasture and arable land, farms with their orchards and clumps of trees being scattered over the landscape. The tourist or globe-trotter would see a dull little town in a flat country, and nothing more. But how different would be the view of a trained geographer with a knowledge of history! To him the little town of Sluys would be a spot of deep interest. Knowing the gradual changes that have taken place in the course of centuries, and seeing the results, he would proceed to inquire into the causes, and into the ways in which those causes can be assisted or retarded by human skill and industry. There are the Dunes protecting Holland from destruction, the Zuyder Zee, and the tracts of reclaimed lands. Still more striking are the changes, within historic times, that have taken place in Jutland and along its coasts.

The coastal belt of England, from Flamborough Head to Portland, offers a subject of geographical research which would be alike interesting to the inquirer, and useful to the country. Municipalities whose towns are on the eastern coast of England look forward to such researches as likely to result in the collection and classification of valuable information. Since Roman times the coast of Holderness has receded more than a mile. Villages, and even a town returning members to Parliament, have disappeared. Great changes have also taken place in the channel of the Humber. There have been, and there still are, intelligent observers of these changes, books have been written; indeed, there is an extensive literature on this subject alone, and even a bibliography. But what is urgently needed is that some lover of geographical research should undertake to condense all this material, as well as to observe closely with his own eyes. Such an undertaking would be a worthy result of courses of instruction here, and the public-spirited man who should be willing to devote some of his time to it would be performing an important public service. Equally useful research might be entered upon on the other sections into which the eastern coast of England may be divided.

A course of study which embraces these phenomena, the mountain systems, the river basins, the deserts, the coastal belts, is one which will furnish the student with knowledge of the greatest value to him, and with a training enabling him to understand and to investigate problems for himself. Every natural object on which his eyes rest, every landscape he enjoys, will convey to him meanings they never had before.

When we pass from surveying and the physical aspects of this world to the regional geography and the environments of man, we begin to contemplate the world as the abode of life, of vegetable and animal life, and above all of man. We now study it not exclusively for a knowledge of its dimensions and its physical aspects, but in order to learn how these elements bear upon the conditions of life, and act and react upon the dwellers of our planet; how they enable life to appear, to find sustenance and well-being, and to complete the work for which living beings are designed and brought into existence.

Mr. Yule Oldham's course will include regional geography, I understand, while Dr. Haddon has undertaken to lecture on ethnology and anthropology, to describe the different races of men and their several environments, explaining the way in which their various conditions have been influenced by the circumstances under which they live.

Such knowledge is a necessity for all educated men, so that obviously the more thorough and complete that knowledge is, the better it will be for its possessor. The course will inform us respecting the countries of the Earth and their inhabitants, considered in relation to the influence of physical features from an economic, a strategic, and a political point of view.

Here again the importance of knowledge may be illustrated by the disastrous consequences of ignorance. This country possesses a great dependency in the East, but on its coast there is a small district occupied by a foreign power, about 2 miles in extent. Absolutely useless to its possessor, it was a serious inconvenience to us, because malefactors constantly escaped over the border and could not be brought to justice. During the war this district was taken by us and became a part of our great dependency. But when the terms of peace were arranged, our Minister for Foreign Affairs, in total ignorance of its position and of the importance of its retention, ceded it to the power that had previously held it. He did so, thinking it was a small West Indian island of no consequence. Thus the inconvenience to the proper administration of the country was continued.

A much more recent instance of the urgent need that a knowledge of geography should be possessed by our rulers is shown in the case of the Chumbi valley, respecting which Sir Frank Younghusband made a well-considered treaty arrangement with the ruling lamas of Tibet. This excellent clause in the treaty was disallowed, and its adoption was censured at home, because ministers were ignorant of the position and history of the Chumbi valley and of the race to which its inhabitants belong. They thought it was in Tibet. It had been occupied for some years by aggressive lamas, but it is entirely on the Indian side of the Himalayas, wedged in between Sikkim and Bhutan, and the inhabitants are not Tibetans. This disastrous reversal of a wise and far-seeing arrangement is detrimental to the interests of our Indian Empire. Blunders of this nature will not be committed in the future by ministers who have gone through courses of geographical study under Mr. Yule Oldham and Dr. Haddon or their successors.

In commerce the consequences of a want of thorough geographical knowledge is quite as disastrous as it is in politics. A merchant, a shipowner, or a planter will take care to have a thorough knowledge of geography if he understands his own interests. The products of all the countries of the Earth, and their requirements when transplanted from one region to another, should be understood by men occupied in such pursuits. This, of course, involves an intimate knowledge of the climatic conditions, the requirements as regards aspect, and the habits essential to the successful treatment of each product down to the minutest detail. The vanilla plant is fructified by an insect. It was thought a great thing to transplant the vanilla from the West to the East. But the plant would not fructify. The little fact about the insect, beautifully described by Darwin, I think, was not known. The vanilla plant in the East is now, I believe, brought to perfection artificially.

One of the most interesting points connected with commercial geography has been the transference of animal and vegetable products from one region to another, where the environment is equally adapted to enable them to thrive. For it is obvious that the success of such enterprises necessitates a thorough knowledge of geography in all its branches. Even centuries ago, in undertaking such work, those who succeeded owed their success to having carefully considered geographical conditions.

By far the greatest and most important examples of successful interchange of products is that which took place between the old and the new world. The old Inca historian, Garcilasso de la Vega, gives us most interesting details respecting the introduction of old-world products into Peru and Chile: wheat and barley, the vine and the olive, garden vegetables, the sheep, the pig, the cow, and the horse. The introduction of the horse into South America is specially interesting, because it altered the habits of a whole people. There had been a horse in America in geological times; indeed, the horse appears to have originated in America. But it had disappeared long before the days of Columbus. Yet the pampas of Argentina and the prairies of the north are regions peculiarly adapted for a rearing-ground for horses. Well, the people of those pampas and the Patagonians had no horses. They had to resort to stalking with bows and flint-headed arrows, dressing themselves to resemble their prey, and stealthily creeping from bush to bush to get within shot of the ostrich or the swift guanaco. In 1540 Mendoza landed a few horses at Buenos Ayres. Scarcely forty years had passed away before the great navigator, Pedro de Sarmiento, met with mounted Patagonians on the shores of the Straits of Magellan. In one generation they had changed their whole manner of life. From stealthy stalkers, creeping on foot to reach their prey, they had become expert horsemen, riding down their quarry in the open, and hurling the *bolas* or the lasso. Such are the changes effected by the introduction of products from the old to the new world.

Perhaps even greater benefits have resulted from the introduction of American products into the old world. Indian corn, potatoes, and cassava are now the food of millions of old world races. Tobacco was unknown before Columbus saw the natives of Cuba smoking in the very peculiar way he describes. Now tobacco appears to be a necessity throughout the old world. Chocolate also, vanilla, and several priceless drugs come from America.

The introduction of the quinine-yielding chinchona tree from Peru into British India and Java is an example of the necessity of a careful study of geographical conditions to ensure the success of an enterprise. For it was not only the transplantation of a tree from the new to the old world; it was also the conversion of a wild into a cultivated plant. Consequently, the mountains and ravines on which it grows wild had to be studied, as well as the climate and conditions of soil and aspect best adapted for the production of its febrifuge alkaloids in largest quantities, and the special surroundings needed for the different species. Then an equally careful study had to be made of mountains in India, in order to find analogous conditions in the Nilgiris and other parts of the western Ghats, and in the mountains of Darjiling. This is all, or nearly all geographical work, and through it an important result has been secured. Fifty years ago the chinchona trees were not cultivated. They grew wild in the depths of the primeval forests, where they were searched for and destroyed for their bark. Their total destruction was only a question of time. The price of an ounce of quinine in London was 10*s.*; in India it was much more. It was entirely out of the reach of the natives. Fevers raged unchecked. Now there are large plantations of quinine-yielding chinchona trees in British India and Java. The price of an ounce of quinine in

London is only 1*s.*, and the natives in India can obtain the febrifuge at every post-office for an anna ($\frac{1}{2}d.$).

This is commercial geography. Similar successes might be told respecting other like enterprises, if there was time. It must suffice to refer to the India-rubber trade, because of the great demand, which is likely to increase a hundredfold in the time to come. The rubber-yielding trees are scattered over the tropical zones of both hemispheres; of quite different degrees of merit, also belonging to different families of plants. The forests of Brazil, Peru, and Bolivia abound in the very best kind, *Hevea elastica*, the Pará rubber of commerce. It requires a very moist soil and humid climate. The *Castilloa* of Central America needs different surroundings. The Brazilian Ceară rubber, which is good, flourishes in a dry climate. The *Landolfia* of Africa and *Ficus elastica* of India are inferior, but fetch a good price owing to the great demand. All grow wild. None are under cultivation, except perhaps *Hevea*, which I introduced into Burma from South America. I hear that there are now plantations of it in the Malay peninsula. A commercial geographer, after a diligent and comprehensive study of the subject, might make a fortune in the rubber trade by entering upon a well-conceived planting enterprise.

If geography is a necessity for the trader and the planter, it is still more essential for the historian. We must all know what history is without it, and how the best histories are those which, like the great work of Herodotus, give geography its proper place. Nothing can be finer than the account of the Athenian siege of Syracuse by Thucydides, owing to his accurate topographical descriptions. The late Mr. Freeman lamented the absence of geography in his education, but he either took a geographical expert with him when he explored the battlefields he had to describe, or consulted one afterwards.

Mr. Yule Oldham's course will include the history of discovery. He will make known to you the work of Rubruquis and Marco Polo, the labours of Prince Henry the Navigator, and the voyages of Columbus, Vasco da Gama, and Magellan. We also entertain the hope that he will introduce to you the work of a less-known but still eminent navigator, Ça da Mosto, and that he will yet find time to edit the journal of that worthy, and give it to us in an English dress.

Geography derives much of its charm from the stories of discovery and exploration which illustrate its records and serve as glorious incitements to further effort. England owes much to her explorers by land and sea, her pre-eminence, her colonial empire, and her commerce. Every Englishman should be conversant with their aspirations and with their deeds, not deriving his knowledge from meagre abstracts, but from their own words, where they have been preserved, if not from contemporary accounts.

A public service of considerable importance has been performed by

Mr. Macklehose, the printer to the Glasgow University, in having brought the great work of Hakluyt within reach of everybody in twelve handy octavo volumes. Before this new edition was published the contents of the costly folios were inaccessible to the great majority of readers. It has been truly said that Hakluyt's 'Principal Navigations' is the real English epic. It is the story of the noblest work of our noblest men. It is an inexhaustible record of information, of glorious deeds by flood and field, of discoveries gallantly made and modestly told, of sufferings bravely faced, of efforts often crowned with success sometimes doomed to failure, always stubbornly and resolutely made, of chivalrous endeavours, and of great and most valuable services. Few can rise from its perusal without feeling a glow of enthusiasm, and a longing to emulate such deeds.

It is, therefore, right that the history of geography and the history of geographical discovery should be included in the courses of instruction. They supply that food for the imaginative faculty, that romantic interest, without which the study of geography would be useful and instructive indeed, but would want that zest which makes it a favourite pursuit. With the setting of great deeds of derring-do, of stories of martyrdom for country and for science, the picture is made perfect, the study is made complete.

I have striven, in a short time, to bring to the notice of those present the great value of geography both as a study, and as a body of knowledge which is necessary to accoutre a worthy aspirant to fame and to success in any profession he may select. I have endeavoured to arouse an interest in all the various branches of a great subject, and if I have been so fortunate as to have succeeded, I shall be more than repaid. It is my earnest hope that the courses of geographical instruction during this term may inaugurate a vigorous seeking for knowledge, and win for geography its proper place at Cambridge.

OSCILLATIONS OF SHORE-LINES.*

By Professor Dr. FRIDTJOF NANSEN.

VIEWS have differed much as to the variations of oceanic level, or rather of the shore-line of the continents, during geological ages. It seems to be a common opinion that the continental coasts have even recently been subject to great permanent changes of level: at some places they have been much elevated, whilst at others they have been depressed, and they still remain at these different levels.

* Research Department, March 28, 1905. Diagrams, p. 708.

I believe a thorough systematic investigation of the question must prove that this view is not correct, for there are many and strong evidences that the mean level of the continental shore-lines have for long geological periods past been very nearly the same as to-day over vast regions of the Earth.

The best evidences for settling the question of the level of the shore-line during past periods, are the coastal platforms and terraces formed by the so-called marine denudation (*i.e.* marine and atmospheric erosion combined). I shall especially mention two great features of this kind existing along the Norwegian coast, viz. the *coast platform* (strand-flat) near present sea-level, and the *continental shelf*, some hundred feet or more below it.

The *coast platform* is a very characteristic feature along the whole of the Norwegian coast from Christiania to Finmarken, forming as it does the almost continuous belt of low islands and skerries (the Skjærgård). The coast platform is situated between 100 feet below present sea-level and 100 feet above it. Its level is almost exactly uniform along this considerable distance, extending over more than twelve degrees of latitude. It is in some places, *e.g.* off the coast of Nordland, between Drontheim and Lofoten islands, very broad, as much as 40 miles, or even more.

Its very conspicuous level is almost perfectly horizontal, sloping only a few minutes seawards. It is a remarkable fact that a similar coast platform does not seem to exist along the coast of Finmarken (east of Sörö), where the coastal rocks are comparatively soft. It is similarly remarkable that Shetland and the Færoes have no coast platform, and on Iceland it is but slightly and imperfectly developed, although the marine denudation in these places is very considerable. Along the west coast of Scotland there is only an imperfect coast platform, to judge from the charts. The broad Norwegian coast platform was chiefly formed after the valleys and fjords had been carved to a very great extent. Broad level platforms of this kind cannot be cut by marine denudations on an undissected coast, and Richthofen's plain of marine denudation (Abrasions-fläche) can never be formed to any great extent. In the extremely shallow sea over a submerged, nearly horizontal, and undissected coast platform, the force of the waves would be broken long before they reached the shore; and besides, there would be little opportunity for the waste to be washed away into deeper waters. On a coast deeply dissected by fjords and inlets, the conditions are entirely different. The line of attack of marine denudation is immensely increased, the waste is easily washed into the deeper channels and fjords. The waste on land, on the small islands and promontories, has a short way to travel to reach the sea, and thus the rate of atmospheric erosion is much increased.

The coast platform of Norway was probably formed during glacial and inter-glacial times; it has not changed much in post-glacial time, and is probably to no great extent a pre-glacial formation.

There have been numerous oscillations of sea-level or shore-line during the formation of this platform, and this is the reason why it is not seen above present sea-level where the coastal rocks are comparatively soft (*e.g.* Finmarken, Færoes, Iceland), or where the marine denudation is particularly active (*e.g.* Shetland, Færoes), for there the platform has been eroded down to near the lowest situations of the shore-line during these oscillations, even though it may have lasted only for a comparatively short time.

The *continental shelf* along the Norwegian coast varies a great deal as to depth and width. It is at some places, *e.g.* off the Romsdal coast and Lofoten islands and Vestralen, high and narrow, lying at a mean depth of about 200 or 300 feet, while at other places, especially off the Nordland coast (between Drontheim and Lofoten) and north of Finmarken, it is very broad and deep, lying between 700 and 900 feet below sea-level.

The continental shelf must either have been cut in solid rock, or is formed by coastal deposition of continental waste.

Along the Norwegian coast the shelf is evidently to a very great extent cut in solid rock, for—

(1) It is high and narrow where the coast is composed of hard primary rocks, while it is lower and much broader wherever the coastal rocks are softer.

(2) The existence of longitudinal and transverse submarine valleys on the shelf, evidently conditioned by the geological structure of the underlying rock, proves that the shelf has not been so much filled up with sediment as to extinguish the sculpturing of these rocks.

(3) The fact that in other neighbouring seas submarine plateaux and banks exist far from the coasts, and situated exactly in the same level as the continental shelf, is of importance in this connection, for these banks cannot have been formed by any coastal deposition of waste. Their remarkably horizontal levels must have been formed by denudation. As examples of such submarine plateaux may be mentioned the Færoe bank (south of the Færoes), Rockall bank, Porcupine bank, Newfoundland bank, etc.

(4) Rocky islands occur far out to sea on the continental shelf (*e.g.* off the north-west coast of Scotland, where we have Sulisker, North Rona, etc.) to prove that the platform of the shelf must, to some great extent, be composed of solid rock.

(5) Hard, rocky bottom has actually been found by soundings in many places on the continental shelf off the Norwegian coast, off Iceland, etc.

(6) The very steep slopes at several places along the margin of the Norwegian continental shelf (*e.g.* north of Lofoten islands) could hardly

exist unless the shelf was, to a very great extent, built up of solid rock.

(7) The plane of the continental shelf forms in a profile a very conspicuous incision in the slope of the continent, and the coast is bounded by a very steep and abrupt descent towards the surface of the continental shelf.

All these evidences prove that the continental shelf, to a very great extent, must be built up of rock, and must actually have been cut back by erosion. But at the same time the continental shelves are evidently also, to a very great extent, built up by coastal deposition of waste. The relation between these two modes of formation is actually much the same as between the raised shore-lines cut in solid rock, and the raised beaches and terraces built up of loose materials along the Norwegian and Scotch fjords. The lines of the old sea-levels very often run continuously from the one kind of these formations to the other.

As the continental shelf is cut in solid rock to a very great extent, its present surface cannot have been developed at present sea-level, but during times when the shore-line was much lower. The history of formation of the continental shelf has probably largely been much the same as that of the coast platform. It has similarly been formed along a much dissected coast. To some extent it may, however, also have been developed as a peneplain. The continental shelf must have been formed during periods of vertical oscillation of the shore-line, and, in a similar way as we saw above has been the case with the coast platform, the continental shelf has been cut to its lowest levels during these oscillations where the coastal rocks were comparatively soft, or where the marine denudation was most active.

It is a striking fact that, at least to some extent, the continental shelf is very often developed to its greatest width in those regions where storms are most numerous and severe. It is in this connection also worth mentioning, that the effect of wave-erosion on a coast is proportional to something between the *third* and the *sixth* power of the velocity of the wind. The continental shelf, as well as the coast platform, consequently prove that changes have occurred in the situation of the shore-line and the sea-level. Is it not possible that these changes have chiefly been caused by a gradual rise of the ocean level?

The submarine fjords and valleys have evidently been opened or re-opened after the continental shelves were developed to their present form. These submarine valleys descend below the levels of the shelves while crossing them, and they thus disprove the above explanation. As examples may be mentioned the system of submarine valleys of the Barents sea, of the Norwegian coast, of the Færoes, Iceland, Greenland, America (the Hudson submarine channel), Europe, and even of Africa.

As an evidence that the sea-level has at some not very remote period been lower than now, may also be mentioned the submarine ridge extending from Scotland to the Færoes (Wyville-Thomson ridge), from thence to Iceland, thence to Greenland (and perhaps also from Greenland to Baffin Land). This ridge has, it seems, very uniform depths, varying between 200 and 250 fathoms, and it is, in my opinion, probable that the surface of this ridge marks an ancient sea-level, towards which the ridge was cut down by a very active erosion (marine denudation and atmospheric erosion combined). On the side slopes of this ridge traces of submarine valleys probably exist, indicating that the shore-line was once even considerably lower.

We have, as it is seen above, strong evidences to prove that the level of the shore-line has oscillated much below as well as also above the present shore-line, along most continental coasts, during recent geological periods. But it is a very important and striking fact that, in spite of these great oscillations, the shore-line along nearly all coasts is, at the present moment, very much at the same level as it has been during by far the greater part of recent geological periods, as is proved by the extensive continental shelves, by the coast platform in Norway, as also by the extensive continental plains of Asia, Europe, and America, the mean level of which approach present sea-level. In fact, nearly one-half or 41 per cent. of the continental surface of the Earth stands between 650 feet below and 650 feet above present sea-level.

What is the cause of the above oscillations of level? Is it the ocean-level which has changed, or are the oscillations due to movements of the crust?

In Norway we find the coast platform without interruption situated very nearly at its original level, and only slightly elevated above the sea, although the same coast-line has in post-glacial times been depressed in some places, *e.g.* in Nordland, 380 feet below present sea-level, while at other places very much less, *e.g.* in Lofoten only 30 to 60 feet. The coast has consequently, in spite of this great difference in its depression, been afterwards elevated almost exactly to its original level which it had before it was depressed. This seems to prove that the land or the crust has a remarkable tendency, after disturbances of its level, to return to a certain mean position of equilibrium; the explanation in this case being, in my opinion, that it was the weight of the ice-cap during the last glacial epoch which pressed the land down, and when the weight of the ice was removed the crust gradually re-assumed its former level.

In a similar way we have probably to explain the fact that, for instance, submarine river-valleys cross the continental shelves and descend to comparatively great depths, although these valleys have evidently been opened or re-opened after the present shelf was formed. The disturbances of level during which these valleys were formed may have lasted for comparatively short periods, and when the strain causing the disturbances was removed the crust re-assumed its original position of equilibrium.

But apart from this we have, however, also to contend with the fact that the continental shelves almost all over the world stand very much at the same depth, varying mostly between 300 and 480 feet below present sea-level. This important fact, as well as the evidences borne out by the coral islands and other things, seem to indicate that the level of the ocean has, on the whole, risen somewhat during late geological times.

The following discussion took place :—

Sir Archibald Geikie: I have listened with great interest to the discourse of my old friend Dr. Nansen, and I have also had the advantage of reading the book to which he referred, namely, the fourth volume of his report of his North Polar Expedition. So far as I have been able to follow him to-day, and to gather from the reading of his book, I should imagine that the continental shelf in Norway, as with us here, must be a very old story. It seems to me Dr. Nansen is right in believing that this shelf marks no particular coast-level, but has been eroded during numerous oscillations, when both marine and sub-aërial denudation came into play. This submarine feature is only one of a series of similar platforms of older date which form part of the land. An instance of these more ancient terraces may be seen in Norway, where the great platform on which the snowfields lie is evidently an extremely old continental shelf that has been cut down in all directions until only fragments of it are left. In the same way in Wales, as Sir Andrew Ramsay long ago showed, the general upward limit of the hills of South Wales ends off along a line which he described as a plain of marine denudation. Again, in the Southern Uplands of Scotland we have only to climb to the top of some central hill to see how uniformly the hills end off in one general plain which has been cut across the edges of the strata. In the Highlands also, among ancient crystalline rocks, some portions of a similar but more elevated plain are so flat and so extensive at a height of 3000 feet as to be fit for a racecourse. But outside these fragmentary areas, which at a distance appear as flat-topped hills, the old tableland has been deeply trenched into valleys, with narrow ridges between. I have listened also to Dr. Nansen's remarks about the inequality of movement in the oscillations. I quite agree that these movements were not due to any change in the mere surface of the oceanic level, but to some unequal movement of the land. But I am afraid I cannot share his belief that changes in the volume of the ice of the Ice Age will explain the depression or elevation of the land. I should just as soon believe my friend Dr. Nansen is depressed by wearing a hat and is elevated by taking it off. It seems to me that the thickness of the Earth's crust is far too great to have its stability affected by the most colossal ice-sheet that can be reasonably conceived to have ever rested upon it.

Sir John Murray: I have listened with very great pleasure to this interesting paper. There are a great many points that may be referred to. I should like to say a word or two about the Wyville Thomson ridge, where I spent two seasons dredging and sounding with Captain Tirard. At the present time that ridge is at an average level of about 250 fathoms, and about 5 to 10 miles across. There you dredge up fragments of stones of very considerable size. I still have all these stones in Edinburgh, a very large collection. The top of that ridge is being denuded at the present time, in my opinion, for on the top you never get any sand or mud, but on dredging down the slopes to the north and south you get finer and finer gravel, and ultimately you get down to the mud. The particles on the northern side have, I believe, been derived from the top of that ridge. You have glauconite forming, and a typical continental deposit on both sides of that ridge. This is one of the deepest places that I know of where there is good evidence that marine erosion is going on in deep water. The tidal wave travels up the North Atlantic, and on approaching the Wyville Thomson ridge the wave is confined, so that it rushes across that ridge at a rate that carries all fine particles from the top. On the top of that ridge we find rock fragments showing glacial markings, proving they must have been carried at some time or other by ice. There is a relation between the depth of the continental shelf and the violence of the storms to which the coast is exposed. At the present time I am engaged in the examination of a very large collection of rocks and stones and muds that have been dredged on the Agulhas bank off South Africa, and there you find this continental shelf deeper than in most other regions because of the frequent storms in this region. In fact, the depth at which mud commences to settle and accumulate on the sea floor marks, in many places, the position of the continental shelf at the different parts of the coast. I do not know why Dr. Nansen should come to the conclusion that the 100-fathom line does not exist. It exists as well as any other line. He means, I suppose, that, though on our English charts we generally draw in that line, it does not mark the edge of the continental shelf. But he has not stated at what depth he would place the continental shelf in various regions of the world, or what he thinks is the mean depth. With respect to the general conclusions, I believe the surface of the sea is a very complicated surface indeed. I do not believe you can have any great change in the continents without producing a slight alteration in the level of the ocean all over the world. Around every continental shore and in every enclosed sea you have deposition going on. You have the weight on the solid crust increasing there, and on the continents you have unloading. Now, it is this that produces, or rather gives direction to, differential movement in the crust. This, I believe, has always tended to shove up the deposits which are laid down along the coast and in continental seas; the deposits that are laid down within 200 miles of the shore have, it would seem, in past ages been continually pushed up into dry land. In this way the continents are not constant or permanent; they are probably the most unstable parts of the Earth's crust, but I believe the areas on which they are situated to be permanent. I have listened with very great pleasure indeed to Dr. Nansen's address.

Rear-Admiral Sir W. Wharton: I would only say that I entirely agree with Sir John Murray as to the very great depth to which movement of the material at the bottom of the sea may take place. I think we are learning more about it every year, and there has been evidence that, as Dr. Nansen has mentioned in his book, the movement of the bottom waters would certainly roll small gravel along at a depth of as much as 200 fathoms and more. You have the tide and you have the heavy gales, and I think it is extremely difficult to limit movement to any particular depths in any particular place unless we know more about the effect of motion of the sea surface than we do. It is also very difficult to limit the depth at which the coast can be eroded. Erosion is one thing, and the disturbance and movement downhill of the eroded material is another. A continental slope may be built up to a very great depth merely by moving the fine material. I think Dr. Nansen refers to that in his book, but I understand he rather wishes to limit it to depths which I believe are very much exceeded.

Sir John Murray: If I might ask a question, I should like to know if Dr. Nansen attributes any effect on coast-lines to the different heights of the tide at various parts of a coast-line. Take the Bay of Fundy, for instance, where the tide rises to an enormous height, but not nearly so high at the opening of the bay.

Mr. A. Strahan: I may say that when I entered this room I thought there would be some subjects on which I should be unable to agree with Dr. Nansen, but I am left with the impression that he has established many points. One difficulty I have is in believing that so large an amount of erosion can have taken place in so recent a period, for I understand that the coastal shelf has, in his opinion, been eroded in immediately pre-glacial times. Now, in our own case, in the south-west of England we have a pre-glacial and a post-glacial coast, both visible at the present moment, and the amount of erosion which has taken place between the two is inconsiderable. On the other hand, those two shore-lines prove a point which I think will be of great interest to him. They prove that the elevation of the land above the sea is the same, within a few feet, now as it was in pre-glacial times. The amount of erosion required to produce a coast platform may be enormous, and may result from renewal of erosion at different periods. Under our feet at this moment we have such a platform, at a depth varying from 1000 to 1200 feet. That platform is nearly horizontal, so nearly, indeed, that an express train could run over it in any direction. It gradually rises to the west, and comes into view in Somerset, and forms Cornwall, Devon, and parts of South Wales. There we can see what the nature of the platform is. It is composed of old folded rocks, turned up and fractured in every direction, but planed off to a level, and upon that platform rest the Oolites and the Trias and various other secondary rocks, more or less horizontally. In the one case they have been washed off it, but under the east of England they still remain upon it, to a depth of 1200 or 1300 feet. Now, the point is that that platform is inclined; it is 100 or 200 feet above the sea-level in the west of England, and is from 1800 to 2000 feet below that level under parts of the east of England. This, and the fact that the platform resulted from erosion during a succession of periods, seem to me points which, on Dr. Nansen's theory, require consideration. I will not detain you any longer, except to express my sense of the high suggestiveness of Dr. Nansen's paper.

Mr. Hudleston: I am afraid I cannot add anything to the discussion beyond expressing my thanks as a geologist to this distinguished oceanographer for the very valuable information he has given us all. There is one question which I would venture to ask of him, and that is with reference to his sections in the Varanger fiord. I gathered, as far as I could understand, that in the case of coast-platform the cutting away of the hard rocks is equivalent to the accumulation of terraces at other areas on the coast, and I should wish to have an explanation as to how far that coincides with the section which he showed us of the Varanger fiord itself. The coast-platform is represented as being 100 feet below the level of the sea, whereas some of the terraces on the Varanger fiord, as we know, are 300 feet above the sea-level. That is a point which might require some little explanation.

Prof. Hull: I am obliged to you for giving me the opportunity of hearing Dr. Nansen. I had not the privilege of making his acquaintance when he was in this country on former occasions, and am delighted to meet him now and to congratulate him on the completion of that magnificent work which he has been carrying out in the Arctic Regions. I must say the description of the polar sea is a perfect revelation to me. When I was engaged in tracing out the isobathic lines indicating the continental shelf along the coast of the British Isles and Europe, I never dreamed that we should have its representative so wonderfully developed as it has been shown to be by the author of this paper in the polar sea. This marvellous continental shelf is certainly one of the most extraordinary physical features on the face of the Earth, or rather below the waters of the sea; and the interest of it is that it is really a very modern discovery. I do not know that in any of the old books on physical geography we should see the continental shelf mentioned at all; but now it has taken a position which will oblige geographers in the future to recognise it, and give it its fair and proper place amongst the physical features of the globe. I need not say that I feel very much gratified that Dr. Nansen has been able to verify the existence of the old river valleys crossing transversely the continental shelf at a great depth. There can be no doubt about that whatever; that he has found them in the Arctic ocean along the coast of Norway completes the evidence, if it was at all necessary to add to it. I would only like to add a word with regard to one particular point to which Dr. Nansen referred, and that is the marginal depth of the continental shelf. In tracing it on the Admiralty charts I found that the 100-fathom contour very nearly corresponded with the steep and sudden descent of the platform along the British Isles; but on tracing it further south along the coast of France, Spain, and Portugal, it seemed to go down to the 200-fathom isobath. It was very clear that there was a difference in the depth of the continental shelf margin to the north and to the south of the English Channel.

Dr. Nansen: I shall try to make a few remarks in order to answer the questions that have been put to me. With regard to Sir Archibald Geikie's remarks as to the age of the continental shelf, I certainly quite agree with him on that point; I believe the shelf is of very old formation. Now, it depends upon what one means by old, but in order to define it more accurately, I should say it goes back to the beginning of the Tertiary period at least.

Sir Archibald Geikie: Do you mean for all the world over?

Dr. Nansen: Not all, for I have tried, especially on Iceland, to trace it out where we have the best opportunity of judging the age, because we know comparatively well when the present surface of Iceland was formed, and it seems to go back to the Miocene period, and consequently the continental shelf of Iceland has been formed after that date. Now, the continental shelf of Iceland is perfectly the same as the continental shelf round the Færoes and the continental shelf of Norway, and it is crossed in a similar way by submarine fjords. The fjords have, however, a somewhat different character from those of Norway, but that is simply owing to the nature of the rock. The Iceland fjords have exactly the same character as the Finmarken fjords; they have broader outline. The Finmarken ones are cut in sandstone, and the Icelandic in basalt, while the Norwegian are cut in primary rocks and have quite a different character. The submarine fjords have also perfectly different characters. In the primary rocks they have deep hollows in their inner parts, going down to 650 fathoms in the Sogne fjord, and in the Hardanger fjord not quite so much—400 or 500 fathoms; while in the Finmarken fjords, as well as in the Icelandic fjords, we find comparatively small depths along the whole of the fjords. But in spite of this, the surface of the continental shelf is very nearly standing at the same depth in these different regions. Now, I will at once refer to the questions asked by Sir John Murray and Prof. Hull and some others, about what we are to call the margin of the continental shelf. This margin is a very difficult thing to define, because its depth differs much, and in most places we have several levels. If we go to Iceland, for instance, we find the continental shelf traversed by broad submarine valleys, and the level of the shelf edge is deeper off these broad valleys than it is between them. The ridges between the submarine valleys traversing this shelf have certainly a tendency to approach a depth of about 100 metres, that is 50 fathoms, and actually, I think, we have to place the upper level of the continental shelf of Iceland very nearly at 50 or 60 fathoms. I believe, also, that the continental shelf of Great Britain has a tendency towards a similar level. You have off the north-west coast of Scotland, composed of primary rock, a bank or a platform with the general floor standing at about 40 fathoms mean level, and the edge very nearly at about 50 fathoms. The best way of settling where you have the shelf's edge is, not to trace it on the map, but to trace it on sections, where the vertical scale is much exaggerated. Now, for instance, taking a section from Ireland to the Porcupine bank (referring to diagram), we find that only a short distance from the coast the sea-bottom sinks down to the floor of the continental shelf at about 50 or 60 fathoms; after having attained this depth it slopes extremely gently seawards to about 80 fathoms (150 metres), when it again descends more steeply to the bottom of the submarine channel inside the Porcupine bank. Now, I say the place where this slope actually makes an angle, that I call the edge of the continental shelf, and that place is situated very nearly between 70 or 80 fathoms, and the Porcupine bank rises to almost exactly the same level. There you have not the 100-fathom line as the margin of the continental shelf, but the 80-fathom line would be nearer. If we go south of Ireland, there are a great many banks with depths about 50 fathoms or even less, and with depressions and channels in between.

Prof. Hull: I think, if you would pardon me for a moment, that is the channel of the old river valley.

Dr. Nansen: Yes, but these banks are remnants of the old continental shelf, and they indicate the original level of that shelf. I may, as examples, mention the Great Sole banks, the Little Sole banks, Cockburn bank, West bank, etc. There we have, I believe, actually traces of an old sea-level situated very nearly at 50 fathoms. That is the top of those banks, and they are all situated approximately on the same level, and in between are broad channels which are also at certain levels, but I believe that these channels have come afterwards, and I believe these banks are actually the last remains of an old platform which has to a great extent been cut down to a lower level. North of Scotland the edge of the continental shelf is hardly anywhere situated near 100 fathoms—it is much nearer 60 or 70 fathoms, and I just mentioned the high platform off the north-west coast, on which a great many rocky islands rise above present sea-level.

Prof. Hull: That is carrying out what I was saying.

Dr. Nansen: Just so; that is the same thing as in Norway. Actually the depth of the margin of the continental shelf differs to a great extent with the geological structure of the coast; that is a very important point to me. It shows that at those places the continental shelf cannot be altogether built up by loose materials, but some part of it must have been formed by erosion. If that is the case, that it has been cut by erosion in solid rock, we are obliged to accept the fact that the shelf has not been formed at present sea-level, but at a lower sea-level, for whatever we mean about waves and currents it is impossible to accept the theory that currents or waves would be able to erode solid rock to any great depth below the sea surface, except on such very exceptional places as Sir John Murray mentioned. I admit that there is a possibility that strong currents may erode to greater depths than waves. I have, however, constructed a current metre for measuring the currents on the sea-bottom, and I have made observations with it on many and very exposed places. I found that at depths of about 70 metres (40 fathoms), and 2 feet above the bottom, the velocity of the currents was no more than 5 or 6 centimetres per second. It is impossible to believe that rocks could be eroded by water-movements like that, which are not even able to move ordinary fine sand. If you examine the surface of the continental shelf of Norway, you can easily see where the current is sufficiently strong to erode and where it is not, because the material changes with the position—the higher parts are only gravel, the lower parts are fine sand; and the lowest part is clay mixed with sand,

and the very lowest is almost purely clay. We come to the conclusion that the movements of the water disturb the sediments on the bottom at depths approaching 100 fathoms or even more, but that is on the most exposed submarine hills. If you have a great submarine plain, as, for instance, the platform of the North sea, you will find clay even at smaller depths than that. But then, I think, it is quite impossible to imagine that the submarine erosion should be able to cut down a platform or a shelf in hard rock down to 50 or 100 fathoms. It is perfectly impossible, in my opinion. I think that the blocks Sir John Murray spoke about on the Wyville Thomson ridge are fairly easy to explain. We had an ice-cap covering Scotland, and we had an ice-cap covering the Færoes; the blocks may have been carried to their present localities either by the glaciers themselves or more probably by icebergs. I do not think, however, we could accept the theory that the Wyville Thomson ridge was altogether built up of moraine material. If that was possible, it would certainly be easy to accept the theory of its erosion at present sea-level, for a ridge composed of loose materials is comparatively easily washed away. So far I have only touched upon the remarks made about the formation of the continental shelf. I tried to express myself as clearly as possible that I believed the continental shelves are formed, not only by erosion, but also by coastal deposition of waste. I think they are greatly formed by a co-operation of both these processes, and, consequently, I do not believe that all the continental shelves of the world are cut in solid rock; many of them may be to a very great extent built up of coastal deposits. And now with regard to the theory of isostacy and the cause of the vertical oscillations of shore-line, I can only say that I do believe that the load on the Earth's crust, or the removal of the load, would cause movement of that crust exactly in the same way as it does with an ice-crust on the sea. I cannot find any other explanation to account for the strange fact that the *coast platform* of Norway has actually been depressed and submerged to a very different extent at different places, but has again in post-glacial time risen to its original level everywhere, and, moreover, it has been the more depressed the further away from the margin of the continental shelf. As to Sir John Murray's question whether it was possible to accept a theory that a rise of the elevated shore-lines towards the interior of the fjords could not have been caused by different tides, the tides being much higher in the inner part of the fiords than near their entrance, I think it is sufficient to remind Sir John Murray that the difference in the height of the raised shore-lines in the same fiords, between their entrance and their bottom, may be something like from 300 to 600 feet. And besides, you never find much tide in the Norwegian fjords; they are very different from the Fundy bay. In these narrow fiords the tide is almost killed. We have no other way to explain the gradual rise of the raised shore-lines towards the central part of the land, than by accepting a different vertical movement of the crust. It has been pointed out that the continental shelf was, of course, formed long periods before the coast platform. I never said that the continental shelf could be of glacial formation, but I do believe that the coast platform has to a great extent been formed during or between glacial periods, because we hardly find it in countries which have not had an ice age. We find it along the Norwegian coast, we find it on Spitsbergen, we find it on Iceland to some small extent, and we find it well developed on the west coast of Greenland, and I believe we find it on the Newfoundland coast; but farther south we find very little of it, and I think that is an indication that it may have had something to do with the glaciation of the land. As to the ancient geological plains, I may say that I have not attempted to give any explanation of them. I have only spoken of the plains now existing and the surface of the Earth as we see it to-day. Of course during ages many changes have taken place of which we know nothing. Those old geological plains have hitherto often been explained as plains of marine denudation. I must admit I do not believe in the formation of extensive plains in that way; I do not believe that a plain of marine denudation can be formed on a coast of solid rock which has not been deeply dissected, because if you imagine that the land were gradually sinking, and this plain was being formed with a gentle slope no greater than, for instance, that of the continental shelf, which is only a few minutes, it is impossible that waves could travel far across such a submerged shallow plain. The waves would simply be killed near the outer margin of the plain, and you would see the opposite thing go on; you would see building up of beaches instead of the formation of a plain. If we should get an extensive plain, it would require many favourable conditions and a great number of vertical oscillations of the shore-line, and even then we could not get a nearly horizontal plain sloping only a few minutes; the plain thus formed by marine denudation on a not dissected coast must slope many degrees. Mr. Huddleston, I believe, referred to the Hardanger fjord?

Mr. Huddleston: No; the Varanger fjord.

Dr. Nansen: I did not speak about the Varanger fjord, but the Hardanger. The Varanger fjord is of a very different type. The terraces must be distinguished from the coast platform, as they are very different formations from the same late period as the raised beaches and shore-lines. They were formed long after the coast platform, while this was submerged in post-glacial times, and they were raised to much greater heights; we may find them at even some hundred feet above that of the coast platform.

That, I think, is all I have to say, except to thank you for the patience with which you have listened to my explanations. I wish particularly to express my most hearty thanks to the Council of the Royal Geographical Society for this opportunity they have given me of bringing my conclusions before so many distinguished scientific men who have made so many important discoveries in geology and geography. I also take the opportunity to thank you for the great sympathy shown me in my work in many ways by the Royal Geographical Society, and I can assure you there is no place in the world to which I like to go better.

The President: I think we may take this opportunity of congratulating Dr. Nansen on the appearance of those splendid volumes giving the scientific results of his great Arctic Expedition. He has not been with us since we received them. I think the meeting will also wish to express its sense of the great value of Dr. Nansen's investigations, some of the results of which he has given us this afternoon in a most interesting paper, which was followed by an important discussion. I now propose that we all pass a very hearty and cordial vote of thanks to Dr. Nansen for this most interesting address.

Dr. John S. Owens sends the following statement with reference to Dr. Nansen's paper:—

Referring to Dr. Nansen's theory as to the causation of the "coastal shelf" being connected with the intermittent loading and unloading of the Earth's crust by the ice-cap, I should like to draw attention to the following evidences of flexibility in the Earth's crust which support this view.

M. d'Abbadie, who erected a delicate nadirane within a quarter of a mile of the Bay of Biscay, found that in 243 out of 359 observations the pool of mercury was tilted towards the sea at high water or away from the sea at low water. In the remaining cases, where this was not observed, the tilting was probably eclipsed by greater local warping of the soil due to other causes. Prof. Milne says that in

Japan and Germany slow changes in position of a horizontal pendulum have been recorded as accompanying changes in barometric pressure. And Prof. Darwin speaking of the effect of atmospheric pressure on the Earth's crust, considered that when the barometer is very high we are at least 3 inches nearer to the Earth's centre than when it is very low. He also computed that with the ebb and flow of the tide along a shore like that of Europe, there is a depression of the sea-bed under high water and an elevation under low water, due to the loading and unloading of the crust, and a corresponding tilting of the land surface adjoining towards or away from the sea; and he considered that this tilting, due to the tide, may be detected up to 100 miles from the coast. Prof. Milne gives the following instances of alteration of level due to varying load on the crust. He found, while experimenting with a pendulum in Tokyo, that the emptying of a well 104 feet away from the pendulum station of about 2 tons of water produced a tilt of 1·36 second. He also found that a horizontal pendulum at Shide, in the Isle of Wight, oriented north and south, invariably crept round towards a valley on the west at time of rain, owing to the loading of this valley by the water, and he further says "on a hill, change of level may be due to the accumulation of moisture acting as a dead weight in the valley below." Mr. H. C. Russell, when testing the Kater pendulums at Sydney, proved conclusively that even the addition of a small weight produced a measurable depression of the crust; a man and a boy standing near a delicately adjusted pendulum producing large deflections, and that produced by a 7-lb. weight, being quite appreciable. Prof. Turner and Prof. Milne measured at Oxford the deflection produced in a pier by a man and two boys moving to different parts of a floor, covered by concrete, round the base of the pier. A horizontal pendulum may be set swinging by standing near the base of its pier; and, more remarkable still, Prof. Milne says it can be adjusted by shifting the position of a 10-lb. weight on the concrete floor carrying the pier.

All these deflections are small, but they are produced by small weights, and seem to indicate a certain susceptibility to depression, or flexibility in the Earth's crust, which, under a great weight like that of a thick ice-cap applied for a long period, might amount to a considerable quantity.

SURVEYS AND STUDIES IN UGANDA.*

By Lieut.-Colonel C. DELME-RADCLIFFE, C.M.G., M.V.O.

The most important physical feature in the area surveyed west of the lake is the Kagera, the largest river running into Lake Victoria. It rises a long way south near the northern end of Lake Tanganyika, and flows nearly directly north as far as the 1st parallel south latitude. It then turns abruptly eastwards, and follows the first parallel more or less closely until it reaches the lake just north of Mizinda harbour. As far as the Mihingame rapids, about 70 miles from the lake, its course is obstructed by a few falls, slight rapids, and rocks. From the Mihingame rapids to its mouth it is easily navigable for a launch or small steamer.

* Continued from p. 497. In the November number of the *Journal*, the illustration on p. 483 is from a photograph by Dr. Hodges; on p. 485, by Captain Dugmore, D.S.O.; on p. 487, by Colonel Coles, C.M.S., D.S.O.

The chief obstacles in the upper part are the Amrun cascades, the Kansori falls, and the Mihingame rapids. At the Amrun cascade the river contracts to a breadth of about 40 yards, and dashes over some rocks into a broader pool 20 feet below. Just above the Kansori falls, which are about a mile above Nsongezi, the river is divided by two beautifully wooded islands into three channels; each of these has a fall or two of its own, hidden by the overhanging trees. Just below the islands the river reunites and jumps over a ledge of rocks 6 feet in height, forming a pretty fall into a broad pool. The Mihingame rapids are quite short, and the fall is only about 5 feet. The width of clear water—about 100 yards in the part surveyed—is maintained with curious regularity all this way. On each side all the way, too, is a belt of papyrus, varying

VIEW ON THE KAGERA RIVER.

from a few feet to some hundreds of yards in width, making the water difficult of access except at a very few points. Where the river flows through the trough-like valleys between the Ankole and Karagwe mountains it has cut a deep bed for itself, the cliff-like banks on each side being sometimes 70 feet in height. Beyond this to the lake the banks gradually get flatter. The depth near the lake is about 18 feet, and the discharge, which I measured about half a mile from the mouth, was calculated by Sir William Garstin to be about 143 cms. per second.

Practically, the only affluents which bring the Kagera any water are the Kakitumba on the left bank, and the Ngono on the right. The former is made up by the Rufua, which comes from Lake Karenge, and the Kachwamba. In the rainy season it has a width of about 30 feet, and a depth of from 8 to 10 feet. The Ngono is about 60 feet wide, 6 feet deep, and has a current of about a mile per hour.

The absence of surface water is very peculiar, and leads to the suggestion that much of the drainage must be subterranean. It rains a good deal, and the vegetation is never withered, although every watercourse may be quite dry.

Just west of the Karenge lake is the Ruakatenge swamp, practically on the watershed between the Kagera and Lake Albert Edward. The Kahenji, or Chombo, which flows from Kazara into Lake Albert Edward, is often a considerable stream, as Captain Harman once found to his cost, for, returning from work after dark, he was carried away and almost drowned. He had to spend the night on the cold, cold ground in his wet clothes, looking at his comfortable camp only 100 yards off across the stream.

The curious big swampy streams in the Ruchigga mountains drain into the Chombo. One of these merits description.

In such steep mountains, and at such an elevation, it would be reasonable to expect an important drainage artery to take the form of a turbulent river, rushing over rocks with frequent cascades and falls. The Kaniamagogo, however, is an extraordinary swamp. In some respects its course resembles that of a glacier. Were it not for the consideration that no impacting of the vegetable matter appears to occur at any point, as might be the case if any general flow of the mass were taking place, it would seem that the whole of this deep mud must be slowly flowing or oozing away in a north-westerly direction. In spite of the frequent heavy rain over this region, no apparent stream exists, except near its junction with the Chombo, and there is only one small patch of open water. I had the mud probed in various directions, but the longest sticks we could procure or join together passed downwards, meeting with no resistance as far as they could reach. The surface is covered with a dense growth of reeds, in some places papyrus. The natives cross it at certain points by jumping from tuft to tuft of the vegetation. In spite of all statements to the contrary, I found it easy to construct an efficient causeway across it, using bundles of reeds and grass as a foundation in layers on the surface. The natives on either side had never made anything of the same sort for themselves. This may, perhaps, be owing to their universal lack of social cohesion, which prevents anything requiring joint effort being undertaken. Perhaps, also, it may be because on both sides they regard the awkward swamp as a protection against each other.

The Nyakafunzo lake or swamp and Lake Karenge are the only sheets of water of any size in the area surveyed. The former is completely choked with papyrus, and in the dry season contains practically the only water to be found in Bukanga. Lake Karenge, on the other hand, is a very pretty little lake, perfectly open, with grassy banks, several tiny islands, and clear water. Its elevation above the sea is 4500 feet.

Looking west from the shores of Lake Victoria, the country appears for the first 15 or 20 miles a vast swamp, out of which rise isolated hills 4000 or 4300 feet above the sea. It seems quite likely that the lake really covered this area not very long ago. The Koki hills are an extraordinary irregular and tangled mass of hills. They have knife-like ridges, rounded slopes, deep-clefted ravines so choked with vegetation that it is impossible to cross them, and irregular valleys running in all directions. Their peculiar formation made the work of surveying them very laborious and slow.

The Ankole and Karagwe mountains are similar, but reach elevations of 6000 feet, compared with the 5000 feet of extreme elevations in Koki, and entailed so much the more climbing. The Ruchigga mountains resemble the others in formation, but reach elevations of 9000 feet.

Just outside the main chain of the Ruchigga mountains lies an isolated hill called Ihunga, a very bold and striking mass 7165 feet high. This

RUCHIGGA MOUNTAINS.

mountain plays rather an important part in the boundary delimitation work. On its summit are the last beacons of the British and German Boundary Commissions' Triangulations, and also the beacon furthest north of the German-Congo Lake Kivu Boundary Commissions. From the top of Ihunga, on a clear day, the view in all directions is splendid. Far away, 70 miles to the south-west, can be seen the truncated cones of some, and the needle-like points of other, peaks of the volcanic Mfumbiro group. Nearer, 35 miles south-west, lies one single great sugar loaf, Muhavurra, rising above the other mountains, like Teneriffe out of the sea, to a height of 13,621 feet. Northwards, across the basin, where Lake Albert Edward is known to lie, I saw Ruwenzori, by great good luck, once, and once only. It was in the evening, and the clouds hid everything. Suddenly a gap opened, and a glorious vision of snow-peaks, blazing crimson in the setting sun as if incandescent, came into view. Streaming from the peaks to leeward were clouds looking dark and smoky, still more heightening the impression of a mountain on fire. The whole seemed to be floating high up in the air. For five minutes only the view lasted, and then the clouds closed in again. Observations were taken from several points in the Survey to a peak on Ruwenzori, which I have called peak "B," in recognition of the fact that Lieut. Behrens took the observations, and from these I have computed the height to be 16,757 feet. I think it possible, however, that even higher peaks may be found further north. To return to the view from Ihunga: due east lies the valley of the Kagera, the largest river flowing into Lake Victoria, consequently the original Nile. Not far away south-west are streams joining the Congo system. The scene, the geographical position, the inhabitants, the fauna and flora, all combine to strengthen the impression that about here lies the focus of Africa, the point where north and south, east and west, may be said to meet.

Near Lake Victoria, in Buddu and Koki, the population is almost entirely Roman Catholic Baganda. Bukanga is also inhabited by Baganda, but Mohammedans, under a most efficient chief named Abdul Effendi, who gave us more assistance than any other along the boundary, and had his people in better order and under better control than any other.

Near the lake the isolated hills only are inhabited, and throughout the country the natives seemed to prefer to live on or between the steepest hills. The change in the population from Buddu to Ankole became apparent on reaching Ngarama. Bark cloth as an article of dress becomes rarer, and the natives are more naked, wearing sometimes goatskins on their shoulders or round their waists. The language is different, resembling that of Unyoro; indeed, they are often referred to as Banyoro. Their huts are not so well built as those of the Baganda, and bananas are less and less cultivated. Bahima types in face and figure are more frequently met with. In short, it is at once evident that this people is a different one. The chief of Ruampara is Duhara, an intelligent Roman Catholic Mganda.

In Kisrebombo's country—Mpororo, Duhama, Rufua, Kahenda, and Kavungo—commences the mixture of the ruling Bahima aristocratic, cattle-owning tribe, with the agricultural Bahororo. This distribution of races continues through Lugarama's country, Wiskatto and Kazara to the eastern half of Makaburi's country, Ruzumburu, and close up to the eastern edge of the Ruchigga mountains. It is a curious and interesting combination. The Bahororo are the original inhabitants of Mpororo, a name now confined to the small area between the Kagera

BOUNDARY PILLAR, TOP OF IHUNGA MOUNTAINS.

and Kachwamba streams. At one time it applied to the whole country now called Wiskatto, Kazara, Rushenyi, Nomtarra, all Kisrebombo's country, and southern Ruampara as far as Nsongezi. The Queen Niawingi, now a decrepit and discredited old chieftainess, is said to have been the last ruler of Mpororo. She undoubtedly once possessed much influence, partly due to superstitious fear. She claimed the power of intercourse with the spirit world, and surrounded herself with much mystery. She lived completely hidden in a hut, from which she was supposed never to emerge. When approached for any purpose, the replies to questions were given in a high, squeaky voice, intended to be accepted as the voices of spirits. This queen lived latterly in the Shagasha valley at the edge of the Ruchigga mountains.

The Bahororo natives live in untidy, badly built huts. They cultivate very industriously, exchanging produce with the Bahima for milk, butter, etc. They do not keep chickens, and eggs in this part of the world are impossible to obtain. They have a few goats, but no cattle, which are the exclusive property of the Bahima. The Bahororo are a quiet, inoffensive race, rarely seen with arms in their hands, and usually dress in skins.

Next to Mpororo, westwards, lies the district known as Rushenyi, under the Bahima chief Muhumuz. From the edge of the hills to the Rufua this district is open, undulating, and grassy, like Mpororo. Near the hills are a few settlements, and some cultivation of the Bahoro; but the open country is quite deserted, except by large herds of zebra, eland, and hartebeeste, and perhaps, at certain seasons of the year, grazing cattle. South of Rushenyi stretches the district known as Nomtarra, under the chief Katereya. It resembles Rushenyi in all particulars.

Westward of Rushenyi, Kavungo, and Ruampara come the districts under the Bahima chief Lugarama. The northern larger and more important part, Kazara, lies entirely north of the Rufua stream and the Karenge lake. The southern part, Wiskattu, is almost all grazing country, though in it are some hills exceeding 6000 feet in elevation.

Wiskattu contains only a comparatively small number of Bohororo, and a small extent of cultivation. The cattle kraals are, however, numerous, and huge herds, numbering thousands, belonging to Lugarama and his Bahima sub-chiefs, are to be seen in all directions. In Kazara, on the other hand, the proportion of cultivated area is very great. The population is denser here than in any other part visited by the Boundary Commission.

North and west of the Kahenji or Chombo lies the country known as Ruzumburu, under the chief Makaburi. Makaburi and Lugarama were the two chiefs from whom we were led to expect a hostile reception. I had been requested to deal with these two men by Her Majesty's Commissioner for the Uganda Protectorate, who gave me a free hand in the matter. Lugarama I saw and made friends with, after his fears had been overcome. Eventually I persuaded him to go to the Government station of Mbarara with Captain Harman. When he returned, he came to me in great delight, and said his heart and that of his people were now still. Makaburi I was unable to see personally, but I sent him messages and presents. I received civil messages in reply, especially after he had heard of my relations with Lugarama, and the treatment this chief had met with. Finally, he was persuaded by Lieut. Behrens, acting under my orders, to accompany him to Mbarara. Thus good relations had been established at last with both these chiefs, without the necessity of firing a single shot It was a matter of great satisfaction that from first to last it has not been necessary to fire a single shot anywhere on the British side of the boundary.

The population of the eastern part of Ruzumburu adjoining Kazara is very similar in all respects to that of Kazara. The Bohororo form the bulk, as there are not many Bahima in this part. The area is not very suitable for grazing, and is much taken up for cultivation. To the west of Kazara the surface of the country commences a general slope towards the basin of Lake Albert Edward.

The Bahima are an extremely interesting race; obviously intruders in this part of the world, their origin is still shrouded in mystery. Tall, well-bred looking, and naturally intelligent, they devote themselves wholly to their cattle. Their villages are filthy and badly built. Except as stock-raisers, they are at present very useless. Although they possess huge herds, it is extremely difficult to induce them to sell any even at exorbitant prices. Cattle have for them a peculiar significance, and they have superstitious fears of parting with them.

In time to come the Bahima country should become a magnificent cattle country, with a large industry fostered by the security of British rule.

The natives of Ruchigga are a curious mixture of the Bantu races of Central Africa. They call themselves Basiggi. Among them are a number of people styled Mugahe, the name signifying "those seeking asylum," who have sought refuge here from some persecution in Ruanda, near Lake Kivu. The Mugahe are externally undistinguishable from the Basiggi. All are a very wild, savage-looking people. Men of extraordinary muscular development are common among them. They state they own allegiance to no chiefs, each man or head of a small group of huts acting according to his own lights. They are usually seen carrying arms in the shape of spears and shields, and occasionally bows and arrows, and they showed at first great suspicion of our intentions.

All the natives in Ruchigga build untidy thatched huts in small groups inside zarebas. They cultivate the soil with great assiduity; beans, Indian corn, peas, millet, pumpkins, sweet potatoes, etc., are plentifully produced. The language spoken by these people is a Bantu tongue, but it was very little understood by the Baganda or Ankole natives. It was said to resemble Kiruanda. The Basiggi and Mugahe keep a considerable number of chickens, goats, and cattle. The Bahima do not appear to penetrate into these hills at all.

In German territory near Lake Victoria the natives are Bahaya and Basiba. They resemble the Baganda in many particulars, but appear a more vigorous, cleaner, and superior race compared with the Baganda of Buddu. The large number of sturdy children among them was in marked contrast to the few rather sickly specimens which represented the coming generation in Southern Buddu. Their fields were very well cultivated, and the produce was in great variety. Missionary effort has not been so successful south of the Kagera as north of the river. Near the lake-shore the Basiba natives may be seen wearing a singular dress made from the fibre of the raphia palm. The women also wear bark cloth and rather curious puttees of bark cloth with metal rings. They also frequently put a broad band of a strip of yellow grass round their heads, which has rather a striking effect.

Near Kivumberu, in German territory, is a large settlement of coast Arabs, a relic of old slave-dealing times, probably. It was quite surprising to come suddenly on the large settlement, stretching a long way up and down the river, with broad streets, well-built rectangular houses with thatched roofs, large gardens, and plantations.

The trees near the lake-shore are large, among which are species

CANOE COMING ASHORE THROUGH THE AMBACH, DAGUSI ISLAND.

allied to the gutta-percha producing trees of the Malayan peninsula. There is a thick undergrowth of shrubs, and the trees are festooned with numerous species of woody climbers, of which many display conspicuous flowers or winged fruits. The only coniferous tree met with was also found here.

A closer inspection of the trees revealed parasitic growths and epiphytes, orchids, ferns, and a cactaceous plant with pendulous, fleshy, cylindrical stems. At the mouth of the Kagera a few ambach trees make their appearance in the shallow water. Mimosa shrubs and plants of the mallow order are to be seen on the sandy banks at the mouth of the Kagera. At the edge of the swamp near the Kagera are large-leaved plants of the ginger order, and low trees allied to the myrtle. The swamp itself, besides papyrus, is occupied by grasses and reeds, with a few herbaceous plants displaying conspicuous flowers, such as the balsams. Near the edges the raphia and the wild date palm are found.

On the hills the natives cultivate many kinds of bananas, also sweet potatoes, yams, ground-nuts, colocasia, tobacco, Indian corn, manioc, coffee, and bark cloth yielding fig-trees. Coffee trees are to be seen in great numbers in every plantation, and the value of systematic cultivation of this plant at once suggests itself. On the hills, also, conspicuous features are the magnificent isolated incense trees, with their rounded domes of dense foliage and huge stems. Very common and conspicuous on various trees is a parasite with dark-red flowers, allied to the mistletoe.

Ten miles west of the lake commences the only piece of real virgin forest met with. It is throughout a dense virgin forest, and almost impenetrable. It consists of very large trees of many varieties, which still require identification, the vegetation generally being different to that of Buddu and Uganda. The upper parts of the tall trees are festooned with a light greyish-green mass, hanging in long streamers, and giving to the forest a very fantastic appearance. When these long streamers are agitated by a storm, they make the whole forest, seen from one of the hills near, look like a rough sea. Again, when the sun is vertical the whole forest appears dark, but when the sun is low the general effect on the sunny side is curiously light. The large trees are bound together with innumerable lianas and creeping plants. Between the stems is a dense tangled mass of lesser vegetation. The forest stands to a great extent in the water and mud of the swamp. A singular feature of it is the abruptness with which it commences and ceases on the plain. The grassy swamp or open country reaches to the mighty wall of trees, which continue in the same density from one side to the other of the mass. There is no smaller wood or scrub outside, forming a transition from the open plain to the forest. Inside, the silence and gloom are accentuated by the apparent absence of animal or bird life. There are some herds of buffaloes that make it a headquarters, elephants visit it occasionally, monkeys and parrots are sometimes seen, and a harnessed antelope now and then appears at the edge; but the general impression left is one of lifelessness.

Specimens of the prevailing trees could not be obtained, owing to the difficulty of marching near or through the forest, and the short time which was spent in this neighbourhood. It must be mentioned that during the brief inspection which was possible no rubber vines were actually seen. On the fringes of the forest near the river, but especially south of the river, wild date palms are very numerous.

The undulating grassy plains in Bukanga are dotted with ant-hills crowned with shrubs, for the most part thorny and partially covered with succulent and fibrous climbers. On the slightly higher ground are sprinkled thorny acacias. Among the shrubs are some, mostly thorny, capers. Others were seen allied to the spindle-tree. Some species of asparagus were numerous. Most conspicuous among the vegetation were huge candelabra-formed euphorbias, standing out round and black and supplying a positive note to the landscape.

In this area the grass grows irregularly. It is usually less than $2\frac{1}{2}$ feet high, except in the valleys. In the dry season it is burnt, and at the beginning of the rains many bulbs develop brilliant flowers, which show to great advantage on the short, bright-green grass. A stumpy, succulent aloe is very common. Before the grass is burnt this plant is almost hidden, causing one to stumble in the most irritating manner if one leaves the path. Numerous vines, usually succulent, are also to be seen. The large kigelia, with its strange pods, like giant sausages hanging from thin ropes, is also met with here, though it does not appear in the damper region near the lake-shore.

On the hill-sides large acacias are common, also three species of albizzia, a low shrubby gardenia, and a protea. On one hill situated in Bukanga a rubber vine (landolphia) abounded. Among the Ankole hills the gullies, seen from above, are a remarkable sight from the number of shrubs they harbour. It appears that the fires rarely penetrate to their depths. The general size of the trees throughout this district is small. Very few exceed 40 feet, except the acacias, and they but rarely, except along the deep bed of the Kagera river. Here a tall feathery acacia stretches long branches up to heights of 60 or 70 feet. Further west, in the ankole mountains in Ruampara, were the masses of a thorny species of acanthus with mauve flowers. This plant was, in places, a most serious obstacle to the survey work, as, when combined with tall grasses in the valleys, it formed a compact mass exceedingly difficult to pass through. On each side of the Kagera river itself is a dense strip of vegetation, consisting of shrubs and creepers under the tall green-stemmed acacia trees referred to above. The wild date palm is conspicuous above this mass in places, as also are certain cactaceous plants, and an arborescent species of aloe, 15 feet or more in height, terminating in a conspicuous red inflorescence.

The fringe of papyrus at the water's edge is matted with the runners and tendrils of a mauve water-convolvulus. Where the water is sufficiently stagnant, two species of water-lily are to be seen—the one purple and the other white; both extremely handsome flowers.

The natives in Buddu, Ngarama, Ruampara, and westwards, cultivate sweet potatoes, ground-nuts, beans, peas, manioc, a little maize, and tobacco. Yams are plentifully cultivated south of the Kagera, but not north of the river. Bananas are little cultivated to the west of Ngarama, and bark cloth fig-trees coincide with the cultivation of the banana. In Ruampara the plants chiefly cultivated were sweet potato, manioc, a small grain called talabun or wimbi, and castor-oil. In the gullies in the valleys of the hills all round the plains shrubs and trees abound. At the edge of one swampy stream a buttercup was found.

The vegetation of all this district continues to bear the same general character as far west as the Ruchigga mountains. Here, however, it changes very abruptly as one crosses the watershed between the drainage systems of Lake Victoria Nyanza and Lake Albert Edward.

The altitudes are upwards of 6000 feet. Small forests of bracken fern, reaching a height of 10 feet, occur at the tops of the hills, which are further well wooded with various species of the Boraginæ, Sapindaceæ, Meliaceæ and other orders, but no acacias. The trees, as a rule, are of no great size, but have rough bark and a plentiful covering of orchids, mosses, and lichens. Almost all of them have a profusion of orchids, which bear witness to the fact that the mountain-tops are frequently enveloped in cloud, and that the rainfall is considerable. Ground orchids are also extremely common. The grass everywhere is short, resembling turf in England, and the display of showy flowers is very remarkable.

Out of the bracken rises a species of Polygala with purple flowers, and a coleus of candelabra-form habit with dense spikes of light-blue flowers set off by red calyces and red leaves below the inflorescence. A shrub suggesting broom in flower is common, and also a plant resembling mullein. Many plants can be at once recognized as closely allied to species at home. Among these are a St. John's wort, a clover, a meadow rue with singularly long flower-stalks, a wild geranium, a vetch, a chickweed, and a hounds-tongue, closely resembling forget-me-not; also a shrub allied to heath. The lower limit of the giant lobelias was just reached, and one was obtained with a flower-spike 5 feet 8 inches in length. In the depths of the deep narrow valleys, standing in the cultivation of the natives, clumps of dark green, almost black, dracænas were conspicuous, giving a weird, old-world touch to the scenery.

On the return journey of the Boundary Commission three weeks were spent on Buvuma island, during which astronomical observations were being made. This gave an opportunity for an examination of the flora of the island, which disclosed many points of very considerable interest.

The island, which at its highest point is about 600 feet above the level of the lake—not 2000 feet, as has been stated—has a great number of plants which make a more detailed study of the flora, especially from the point of view of its economic value, a matter of the greatest interest. Such a study, to be complete, should be extended over the different seasons of the year, as an examination confined to one portion of the year must necessarily omit a large number of plants which flower at other periods. There is no doubt, however, that a number of plants of great commercial value are to be found on Buvuma island; probably also on the other islands near and on the mainland of Usoga and Uganda.

It is impossible to refer to the botanical collections in closer detail within the limits of this paper. It is sufficient to say that the specimens included a large variety of timber, gum, rubber, drugs, food, oil, fodder, and fibre-producing trees. As coffee, and probably cotton, cocoa, and kola, do very well, also European wheat and vegetables in Ankole, the latter fit for a horticultural exhibition, it will be seen that the agricultural possibilities are great. The collections on the whole indicated an affinity with West African species—even with those of Angola and Togoland. Of South African species a pappea, a chætacanthus, and a pavetta were found, which have not before been collected in tropical Africa. Several orchids found near the western boundary correspond with species collected by Scott-Elliot on Ruwenzori and the Mau plateau. Several new orchids of well-known African genera were found in the Ruchigga mountains. Some species of lannea were found which had been previously collected by Stuhlmann and Fisher. The novelties have been found chiefly among the Gamopitalæ (35), among the Polypitalæ (15), among the liliaceous plants, Amaryllidæ, and orchids (10). In all, sixty plants hitherto unknown to science were discovered. The collection, for which the whole credit is due to Dr. Bagshawe, numbered in all 640 specimens.*

A small collection of rocks was brought home, the larger portion, unfortunately, being lost in transit.

Generally speaking, the geology may be described as alluvian near the lake-shore. Out of this rise isolated hills consisting of sandstone and shales belonging to the Palæozoic series, which have an affinity with the Hospital Hill series of the Transvaal. The Karagwe-Ankole mountains consist for the most part of sandstones, quartzite, and shales. Now and then the basement gneisses and schists make an appearance. In south-western Ruampara a distinctive outcrop of granite is encountered, and the groups of granite hills resemble kopjes in South Africa. Near this group of hills a large pocket of china clay was found, with layers of mica. This was evidently derived from decomposition of the granite. North of the Kagera, in the southern Ankole hills, were ferruginous sandstones with geodes lined with quartz crystals, some of them amethystine in character. In places, large blocks of pure white quartz are scattered on the hillsides. In Koki a pearl-grey sandstone with horizontal ferruginous bands was conspicuous. The amount of ironstone was remarkable in places—on Ihunga mountain, for instance; and in Ruchigga generally the natives smelt a good deal for the manufacture of their hoes and weapons. The valley of the Kagera is alluvial throughout, and is crossed at a few points by ridges of rocks, which give rise to the rapids and falls. No trace of volcanic rock was actually found. The great volcanic region lies chiefly to the east of the lake, round the Mfumbiro volcanoes and Ruwenzori.

The hot springs, Ntagata, on the south side of the Rukatengi

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* Notes on the mammals and birds of the districts visited will appear in the *Proceedings of the Zoological Society of London.*

swamp, are interesting as indicating possibly the relics of volcanic action. The water bubbled out from these springs close together, and was highly charged with sulphuretted hydrogen. The temperature of the water was too high to allow of the hand being kept in it. The natives use the springs for bathing (where the water mixes with other cold water), and for medicinal purposes, internally and externally. Earthquakes were experienced on several occasions, and are said by the natives to be frequent. A seismograph station in this part of the world should yield most interesting results.

None of the stones in the collection disclosed minerals likely to be commercially valuable, and no trace of coal was found.

In a general sense the country in Ankole, Karagwe, and further west appears extremely healthy for Europeans, and admirably suited for colonization. This practically applies to any part of the country exceeding 4500 feet in altitude.

The climate at the Victoria Nyanza end of the boundary was similar to that of Entebbe and other places on the lake. Complete data cannot be given, owing to the want of meteorological instruments, but from the temperatures registered during the technical work of the Boundary Commission, it may be stated that the night temperatures in the open air at 10 p.m. during December and January averaged 68°. The day temperatures at Mizinda in the sun during the same months averaged 78°. At the western end of the boundary the night temperatures at 10 p.m. in the months of June and July averaged 60°.

At camp Msozi mosquitoes were numerous. At Mizinda, on the other hand, mosquitoes were rarely seen, the reason being that Mizinda camp lay a little distance from the lake-shore on a grassy hill. The camp at Mizinda was on a cliff close to the lake, and incessantly swept by the strong breezes from the east across the lake. It was noticeable throughout the eastern districts nearer the lake that mosquitoes were very numerous on the tops of the grassy hills, while down by the swamps they were comparatively rarely seen. For instance, in the swamp near Mizinda, where the base had been laid out, a camp was pitched actually in the swamp itself for the purposes of the base measurements. At this camp, although lights were used in the open air, and the atmosphere was absolutely still, no insects of any description whatever were seen at night. Anopheles mosquitoes were not observed, and all the species seen appeared innocent.

Sleeping-sickness tsetse fly (*Glossina palpalis*) was absent near the mouth of the Kagera.

Camp Mulema was reached towards the end of the dry season, when the grass had been burnt to a large extent. The days were then warm, the nights pleasantly cool. After the rains began the heat was never excessive. Here, too, mosquitoes were common, but of an innocent species, as far as could be observed.

At Burumba, 5200 feet above the sea, the temperatures ruled lower. On dull days the thermometer did not rise above 58° in the huts, and at night and in the early morning the air felt very cold. The camp was exposed to wind blowing up the Kagera valley from the south-east. There were no mosquitoes here, but the health of the natives was not good owing to the cold winds. At Rukirra camp, again, the night temperatures were low, but the camp less exposed, and the days were of pleasant warmth.

On the Ruchigga mountains there was a decided fall of temperature due to the altitudes, 7000 feet and over. The air had an invigorating character that suggested the value of these hills as a sanatorium. When the sun shone it was never unpleasantly cold, but when the hilltops were enveloped in cloud the effect was chilling. On these occasions at night fires were very much needed. There were no mosquitoes on the Ruchigga mountains.

The flat valley of the Kagera lends itself most admirably to the construction of roads. From the mouth of the river to the 30th meridian a road might be traced without any appreciable change of level. Bridges would be almost unnecessary, and a few very small culverts only would be quite sufficient to pass off the water from the lateral streams. If metalling were required, an abundant supply could be obtained from the rocky granite hills bordering the valley of the Kagera throughout its length. Connections with this road could be made under conditions equally favourable for road-making through the rift near Nsongezi, east of the Koki hills, past Kana-Bulem and Simba, or along the coast of Buddu.

Further west the valleys of the streams draining the Ankole mountains offer lines by which roads might penetrate the mountains, though more art and expenditure would be here required to construct roads fit for wheeled traffic.

The communications westwards, along the valley of the Kagera, as far as the Congo frontier, would afford a means of keeping in touch with the part furthest south of the territories belonging to the Uganda Administration, and would open intercourse and trade with the Congo Free State and the regions lying towards Lake Tanganyika.

The Kagera valley, of course, offers equal facilities for the construction of a railway. From the Lake shore, 3726 feet above the sea, to Lake Karenge, 4500 feet, the rise is a perfectly gradual one of 775 feet approximately. Water is available throughout the whole length, and the line could be constructed under the easiest imaginable conditions. Labour could, no doubt, be supplied from Buddu and Ankole. There should be little difficulty in getting the natives to work in sufficient numbers throughout this district at a wage of 3 rupees per mensem.

The open plains stretch away south of Mpororo, and the valley of the Kagera southward appears to offer an opening for the extension of the railway towards Lake Kivu to join with the trunk line coming from the south. It appears that the easiest line for the trunk railway to follow would be the opening of the Kagera valley, down the whole length of which the railway could be carried and continued across Buddu, either through the rift near Nsongezi, round by Lake Mizinga, or by the easier line past Simba, or through Sango to the Buddu coast, and so on towards Entebbe, where the line from Mombasa must eventually end.

If the latter route were adopted, the line could be carried from the western boundary to the neighbourhood of Entebbe with hardly a cubic yard of cutting all the way. The Katonga and Bukora rivers would require to be bridged somewhat elaborately, but besides these rivers, throughout the whole district under discussion, there is no stream which would require a bridge of any size. Ninety per cent. of the streams could be accommodated with small culverts, which would allow ample margin for the greatest rise of water.

The Kagera river itself could be utilized for steam communication certainly as far west as the Mihimgame rapids, 70 miles from the lake. The bar at the mouth of the river, unless a channel were dredged, would limit the size of vessels to such as draw not more than 2 feet of water.

The Bukora river could also easily have a channel cleared, which would enable communication by water to be maintained with the lakes in the interior of Buddu and Ankole. The importance of the line of the Kagera for the purposes of a railway must be specially emphasized. Alternative lines might be suggested to the east and west of Lake Albert Edward, but the Mfumbiro group and the Ruchigga mountains offer serious obstacles.

Again, the country bordering Lake Albert Edward on both sides is very much broken and extremely difficult. The precipitous mountains on the west side continue northwards close to the shores of Lake Albert a long way to the north. On the east side of Lake Albert Edward the hills drop suddenly from the Ankole plateaux with elevations of about 6000 feet above the sea to the level of Lake Albert Edward, say 3000 feet above the sea.

At the north-east corner of Lake Albert Edward is a series of swampy lakes. To the north of it lies the great mass of Ruwenzori, and on the east side of Lake Albert lies Western Unyoro. Here also is an extremely difficult country. Steep hills, alternating with deep ravines and watercourses, run from east to west, the whole dropping very rapidly from a general elevation of about 4000 feet above the sea to 2200 at the level of Lake Albert Edward.

Furthermore, a line of railway which followed the basins of Lake Albert Edward and Albert on either hand would not traverse the most important parts of the Uganda protectorate.

In Uganda itself, the swamps, which are so striking a feature of the country, would not be a serious obstacle to a railway. The water is only a few feet deep, the bottom firm below a foot or two of mud, and the current slow, so that generally a low embankment with culverts or small bridges would be sufficient in most cases to cross them.

These points have thus been referred to, as it appears that the valley of the Kagera is destined to play an important part in the future development of the great lake region of Central Africa, and in the building of the great African Trunk Railway from the Cape to Cairo. Next to good government, the urgent requisite for the development of all this magnificent country is perfection of the means of communication.

Before the paper, the PRESIDENT said: I have great pleasure in introducing Colonel C. Delmé-Radcliffe to the meeting. He has been engaged on very important service in the delimitation of the frontier by the Anglo-German Commission from the Victoria Nyanza to the Congo Free State, and has also traversed the Nile province of Uganda. In the course of this service he has collected a great deal of important geographical information. I now call on Colonel C. Delmé-Radcliffe to read his paper on Western Uganda.

After the paper, the PRESIDENT said: We have to thank Colonel Delmé-Radcliffe for his very interesting paper, which has been most beautifully illustrated. We must all have been struck this evening and on previous evenings with the great addition to our knowledge of African geography that has been contributed by these delimitation commissions. We have had quite recently Colonel Elliott's account of his work on the French boundary, and Colonel Jackson on the German boundary, in Northern Nigeria; we have had Colonel Leverson's Portuguese work; and now we have an immense quantity of valuable knowledge conveyed to us by Colonel Delmé-Radcliffe, collected in the intervals of his more important duty connected with the frontier work. He has described most graphically a very interesting country and its people and animals, and more especially its botany. He has also given us an interesting account of the Nile province. I would, therefore, ask you to join with me in offering our best thanks to Colonel Delmé-Radcliffe, and in passing a vote of thanks to him.

THE VISIT OF THE BRITISH ASSOCIATION TO SOUTH AFRICA.

By A. J. HERBERTSON.

THE most remarkable fact about the visit of the British Association to South Africa is that nearly four hundred members should have been transported 6000 miles by sea to South Africa, carried over some 4000 to 5000 miles there, and be brought home again in the short time of ten weeks. Never has there been a more impressive demonstration of the advance of the material sciences! To its success workers in every section have contributed, from the astronomers and magneticians of A to the schoolmasters of L. If the engineers have combined the results of many investigations in constructing the ways and the means of transportation, geographers, often disguised as sailors and engineers, have discovered and investigated the paths followed. Every traveller becomes for the nonce a geographer, and we may regard the work of the geographical section as lasting for ten or twelve weeks, and all the "over-seas" party to have been members of it. Instead of calling the expedition the greatest picnic on record, it might with even greater truth be described as the most remarkable geographical excursion ever carried out.

PROCEEDINGS OF SECTION E.

The sectional work of the South African meeting was remarkable for being carried out at two different centres—Cape Town and Johannesburg. This meant practically two different meetings under the same organizing officers; and if it entailed a little more planning than the usual meeting, it had the great advantage of securing local contributions of great interest and importance from two very different regions of South Africa.

The section was constituted as follows :—

President: Rear-Admiral Sir W. J. L. Wharton, R.N., K.C.B., F.R.S.

Vice-Presidents: Prof. H. Cordier, D.SC.; Prof. W. M. Davis, D.SC.; Douglas W. Freshfield, M.A.; E. H. V. Melvill; H. R. Mill, D.SC., LL.D.; Prof. A Penck, D.SC.; H. C. Schunke-Hollway.

Secretaries: A. J. Herbertson, M.A., PH.D. (*Recorder*); A. H. Cornish-Bowden; F. Flowers; H. Yule-Oldham, M.A.

Committee: R. à Ababrelton; J. A. Alexander; Tempest Anderson; G. Bennett, M.A., LL.D.; L. C. Bernacchi; Rev. J. O. Bevan; John Bolton; C. D. E. Braine; E. Chassigneux; Captain E. W. Creak, C.B.; Dr. A. Engler; E. W. Ferguson; H. T. Ferrar, M.A.; A. Grant-Dalton; Major Stevenson Hamilton; E. Hutchins; Colonel D. A. Johnston, R.E., C.B.; J. Lomas; Admiral T. P. Maclear, R.N.; John X. Merriman; J. Milne, F.R.S.; P. B. Osborne; P. L. Sclater, M.A., F.R.S.; H. Warington Smyth, LL.B.; C. van der Steer; C. Stewart, B.SC.; Tudor G. Trevor; A. Trevor-Battye, M.A.; F. S. Watermeyer.

Twenty-one papers were read to the section—eleven at Cape Town, and ten at Johannesburg. The attendance at the sectional meetings was not so large as at home meetings; but interesting and valuable discussions were a more important feature than is usually the case.

Proceedings at Cape Town.

The meetings took place in the banqueting hall of the magnificent new municipal buildings.

Wednesday, August 16.—The President's address on "The Field of Geography and some of its Problems" has already appeared in the *Journal.*

Colonel Johnston's paper was read immediately after it, in order to permit him to embark that afternoon on the homeward mail-boat to take up his duties as Chairman of the Redistribution Committee. In it he presented a history of the Ordnance' Survey, a description of the different maps issued by it, which was illustrated by lantern-slides and specimens, and, finally, pointed out the plans which should be adopted in a topographical survey of South Africa, the cost of which, as outlined by him, would be much less than is usually supposed. This paper will be printed in the British Association's Report *in extenso*.

Mr. Bernacchi followed with a survey of the general results of the *Discovery* Antarctic Expedition, which was admirably illustrated by numerous views. Most of the information in his paper has already appeared in the *Journal*. Special stress was laid on the meteorological, magnetic, and seismological work. Both Captain Creak and Prof. Milne took part in the discussion, and supplemented the lecturer's account, the latter pointing out how a discussion of the seismological results had led to the localization of a new centre of crustal weakness south of New Zealand, which also satisfied geo-morphological considerations.

Thursday, August 17.—The meeting this day was a joint one of the Geographical and Geological sections, and was well attended. The opening paper, on the "Physical Geography of Cape Colony," was by Mr. H. B. Schunke-Hollway, vice-president of the section. The author was unwell, but Mr. Cornish-Bowden, Surveyor-General, the local secretary of the section, read the paper, and supplied the maps which illustrated it. The paper will be printed in the *Journal*.

Mr. A. W. Rogers, Government Geologist, then gave an account of the "Glacial Periods in South Africa." There were four groups of rocks of which it had been claimed at one time or another that they afforded evidences of glacial action. The first was in the Table mountain sandstone times, for striated boulders are found in mudstone at Pakhuiss pass. The second group is the Dwyka conglomerate, a consolidated till or boulder clay, which should not be called a conglomerate, and might be named, after Penck, a tillite. In the north this overlies striated surfaces, in a belt from north Natal to the Prieska district of Cape Colony; in the western Karroo it lies unconformably over surfaces which are not striated, and in the south of Cape Colony it lies conformably above the older rocks, and there is no evidence of solid ice actually moving over the surface of the older rock. Many illustrations of this were shown, which, along with specimens which were collected afterwards, sufficed to convince any doubter of the glacial origin of this rock. The third group is the Enon group, but from it no satisfactory evidence had been obtained. The last glacial period claimed was one of recent glaciation, but no good evidence of this had yet been discovered.

In the discussion all speakers accepted the glacial origin of the Dwyka rocks. Prof. Davis pointed out that apparently there had been a *poleward* movement of a large mass of ice on a low surface with little marked relief, and said that this raised the question asked by Prof. Penck, if it was not necessary to consider changes in the position of the Earth's axis. Mr. Rogers thought that the evidence favoured the view that a piedmont type of glacier existed in the north. The existing difference between the valley floors and the crest of the ridges in the Prieska district was about 500 feet, but how much greater it had been could not be determined. The largest boulders were some 12 feet in diameter, and nothing like great perched blocks had been found.

Prof. A. Penck, of Vienna, then read his paper on "Climatic Features of the Pleistocene Ice Age;" and Prof. W. M. Davis, of Harvard, communicated his views on the "Sculpture of Mountains by Glaciers." Both papers will appear in the *Journal*.

Friday, August 18.—Mr. Yule Oldham opened the proceedings with an account of "The Unveiling of the Coasts of Africa." His lecture was illustrated by an admirably selected series of lantern views of photographs of contemporary maps, which presented the progress of discovery in a very telling way.

The recorder then read a paper by Mr. R. Rudmose Brown, of the Scottish Antarctic Expedition, on "Diego Alvarez or Gough Island." This volcanic island, it was pointed out, was some 1500 miles west by south from Cape Town. It was 8 miles by 4, bordered by steep cliffs, 200 to 1000 feet high, the land rising more gradually to 4380 feet, and cut into picturesque ridges and valleys. The rainfall was great, and the streams formed fine waterfalls where they fell over the sea-cliffs. One or two valleys had been cut down to sea-level, and formed the most convenient landing-places. Owing to the stormy seas, landing was difficult. The vegetation was abundant, and the Scottish expedition discovered three new species of plants—two new buntings, and a rich marine fauna. The further exploration of the island was much to be desired, and should be undertaken from Cape Town.*

Mr. Hutchins pointed out how important Gough island was to Cape Colony as a station in the westerly wind tract, from which observations invaluable for forecasting the weather could be sent to Cape Town, if a proper meteorological station were set up.

Mr. Hutchins then read a paper on the "Indigenous Forests of South Africa." He pointed out that the forests of South Africa could be divided broadly into three classes: (1) The dense evergreen indigenous forest, of which yellow-wood was the chief species. It was commonly known as yellow-wood forest. (2) Open timber forest. This generally occupied drier country than the yellow-wood forest, and was forest of an inferior type, though it might contain trees of

* Cf. *Scottish Geographical Magazine* for August, 1905.

the first importance, such as the cedar forest of Clanwilliam and the Rhodesian teak (*Afzelia cunanzensis*) forest of Wankie. (3) The scrub forests of the dry, hot coast-lands and portions of the interior where the rainfall was scanty and uncertain.

There was no timber of large size in the scrub forests, and not much large timber in the open timber forest; the most noticeable was the cedar forest north of Cape Town comprising an area of 116,000 acres. Leaving the western coast and its cedar forests, the dense yellow-wood forest was met as soon as the southern coast was reached. The indigenous yellow-wood forest of South Africa at its best was seen in the form of dense evergreen woods disposed roughly in two stories The lower storey was formed by stinkwood, assegai, hard pear, iron-wood, etc., and the upper storey by the big yellow-wood trees. These yellow-wood trees attained the stature and dimensions of the largest oak trees of Europe. This forest stretched in a more or less broken belt along the coast mountains from Table mountain to the north-east of the Transvaal. The area of the yellow-wood forest in Cape Colony, Natal, and the Transvaal amounted to about 524,408 acres. Across the Limpopo in Rhodesia the forest was at a lower altitude, and of quite another type. Most of the Rhodesian trees were leaf-shedding, and practically all of the species were different from those in the yellow-wood forest. This sudden change in the character of the forest was remarkable. In the north-east Transvaal, on the Woodbush range, essentially the same forest as at Knysna was seen, and only a few species were changed in the long stretch of 1200 miles from Cape Town to the north-east Transvaal. The climate remained much the same, altitude compensating latitude. Beautiful though the indigenous yellow-wood forest of South Africa was, its present economic value was not high, mainly owing to its poor stocking. The average yearly production of timber throughout the forest had been variably estimated at from 6 to 12 cubic feet per acre. Probably 10 cubic feet might be taken as a safe average figure. It was the work of the South African forester to improve the stocking of the indigenous forests with the native trees by cuttings arranged to favour natural reproduction, and, at the same time, to enrich the forest by the introduction of the best of the numerous valuable timber trees which were to be found in the *extra-tropical* forests of other countries. Of such trees he might cite particularly *Cedrela australis*, the premier tree of the Australian forests, and *Sequoia sempervirens*, the finest timber tree of California, and probably of the world. Other two trees, which were doing well as planted trees, were blackwood (*Acacia melanoxylon*) and the camphor tree (*Cinnamomum camphora*). Blackwood spread rapidly with self-sown seedlings and had a timber like walnut. It was hoped that these trees, introduced into the glades and artificial openings in the forest, would gradually spread themselves into the poorly stocked areas around and greatly increase the present low value of the indigenous timber forest of South Africa.

Charles Stewart, B.SC., secretary to the Meteorological Commission, Cape Colony, discussed the "Climatology of South Africa." South Africa consisted essentially of a series of four plateaux, increasing in elevation from the south to the interior: (1) Coast plateau, (2) Southern or Little Karroo, (3) Central or Great Karroo, (4) Northern Karroo, or more properly the High Veld. These plateaux were most distinctly marked in a section from north to south through the centre of the country, but were not so apparent in the east and west, where they were reduced to mere terraces.

Temperature.—One of the most remarkable features in connection with temperature was the great uniformity in mean annual temperature shown by stations differing widely as regards latitude and longitude, *e.g.* the Royal Observatory at Cape Town, Cradock, Bloemfontein, and Johannesburg had practically the same mean temperature of about 62° Fahr. This was due to decrease of temperature with increase of elevation above sea-level almost neutralizing the increase of temperature which would otherwise occur with increased intensity of solar radiation due to a nearer approach to the equator.

A closer examination showed variations of temperature, especially along the coasts, diminishing from north to south along the west coast, from west to east along south coast, from south to north along east coast, due chiefly to the modifying influence of the cold Benguela current in the west and the warm Mozambique current in the east. The extremes of mean temperature were at Disa head (2500 feet); part of Table mountain in the Cape peninsula with 54·°7 Fahr.; and at Tuli in Rhodesia in the Shashi valley (1750 feet), with an annual temperature of 72·°4 Fahr.

The average temperature of 97 stations scattered over South Africa was 62·°8 Fahr., or nearly the same as at Sydney, N.S.W. The mean temperature curve was at its maximum in February, fell rapidly till June, continued to fall slightly in July, then rose with a peculiar flattening of the curve in September to the maximum in February. The continued fall in the July mean temperature was closely associated with a peculiar and apparently regular cold spell about the middle of the month, the minimum for the year occurred on July 16 over the Cape peninsula, and on the 17th at Kimberley. The flattening in September was associated with an increase in the cloud-curve which was coincident with the change of the prevalent wind direction from north-west in August to south in September.

Rainfall.—The curve for South Africa showed two maxima, one in November and one in March, the minimum occurring in July. A comparison of the thunderstorm distribution curve showed that the two maxima in the rain-curve were not coincident with the two maxima in the rain-curve, the maxima in the thunderstorm curve occurring in February (month of maximum mean temperature), and falling till June, then rising again to the maximum in February, with a dip down in November. South Africa might be divided into three rainfall areas according to its seasonal distribution: (1) winter rainfall area in the west, (2) constant rains (small area) in south, and (3) summer rains in the east. Rain fell chiefly with north-west winds in Cape Town and the west generally, with south-west winds along the south coast, and with south-west some north-east winds along the east coast. There was little evidence in support of the "south-east rain" theory, which would apparently have to be abandoned as far as the coastal areas were concerned.

Berg Winds.—These were fœhn-like winds experienced practically all along the coast, blowing from off the plateaux at right angles to the coast-line, being easterly in the west, northerly along the south coast, and north-westerly in the east. Those at Port Nolloth caused the winter temperature there to be higher than that at Ookiep (the reverse holding during the rest of the year), and actually delayed the occurrence of the minimum mean monthly temperature till August. They were clearly connected with the occurrence of secondaries, especially during autumn and the early spring.

Storms.—The storms visiting South Africa seemed to be closely connected with moving anti-cyclones, and assumed apparently and principally the forms of inverted V-depressions, as in Australia.

Sunshine.—The largest proportion of sunshine occurred in the Cape peninsula in summer, and was lowest in winter; whereas at Kimberley, which was typical of the greater part of the central plateau-regions of Cape Colony, the largest proportion of sunshine occurred in the winter months when the days were mostly bright and cloudless, although the night temperatures were frequently low (below freezing-point) and severe. This fact had an important bearing on the suitability of the Karroo for phthisical patients and other invalids.

At the conclusion the President proposed votes of thanks to the Mayor and Corporation for the use of the banqueting hall for the meeting-place of the section, and to Mr. Ainslie, a member of the South African Association, who had given his services as lanternist.

Johannesburg.

The meetings were held in one of the lecture-rooms of the Transvaal Institute, and although the section-room was smaller than at Cape Town, it was large enough for the audiences, and had the advantage of being close to the meeting-places of other sections.

Tuesday, August 29.—Mr. Douglas W. Freshfield, Vice-President of the section, opened the proceedings by giving an account of the Sikhim Himalayas—the country through which our troops had to pass on the way to Lhasa—and the Kangchenjunga mass. This was illustrated by numerous lantern-slides.

Mr. Tudor Trevor, Inspector of Mines, described the "Physical Features of the Transvaal," in a paper which will be published in the *Journal*.

Mr. Ferguson read a paper by Mr. Van de Steer on the "Triangulation of the Gold Fields," of which he gave a detailed account.* This had been carried out for the most important section under the supervision of Mr. H. C. Melvill, the Vice-President of the Geographical section; and, among other points, brought out the accuracy of Mr. Melvill's method of adjustment of errors by correcting directions.

Mr. F. S. Watermeyer's paper, "Geographical Notes on South Africa south of the Limpopo," was read by Mr. F. Flowers, the local secretary of the section. In it an account was given of the cartography of South Africa, a summary of the history of the people, and a general review of the physical features and climatic characteristics of the country will appear in the *Scottish Geographical Magazine*.

Wednesday, August 30.—Captain Ettrick W. Creak read a paper on "Terrestrial Globes: a Necessary Adjunct in the Teaching of Geography." He strongly urged the greater use of the globe, which, rather than maps, should be the basis of sound geographical teaching, and he cited the late Prof. Elisée Reclus' paper to the R.G.S., and quoted Lord Kelvin's opinion that "the neglect, the almost total cessation, of the use of the globes" had been "a very retrograde movement."

Mr. J. Lomas, of Liverpool, then gave an outline of the methods he adopted in school excursions, and in teaching the use of maps by making models, and illustrated his remarks by a series of lantern-slides of photographs taken during an excursion, and of the maps and models used. He mentioned that they had been able to take school-children from Liverpool to North Wales for a fortnight at a time, and that such excursions had proved very successful.

Prof. W. M. Davis, of Harvard, then presented an account of the ideal cycle of land forms in an arid climate, which led to an interesting discussion. This will be published in an early number of the *Journal*.

Friday, September 1.—Thursday was reserved for excursions to Pretoria. On Friday Major Stevenson Hamilton read a paper on the "Game Preserves of the Transvaal," of which he is the Warden. His account of the success attending the efforts of the Government to preserve game in the eastern low veld, which were begun just before it was too late, was of much interest.

Mr. J. Bolton then communicated a brief review of the boundary problems of Africa, pointing out where they had been settled by treaty and survey, and where they were still indefinite.

* This paper will appear in full in the *Journal* of the Institute of Land Surveyors of the Transvaal.

A new rainfall map of Africa, by Messrs. Herbertson and Waite, was shown, and the changes necessitated by the accumulation of new data during the past eight or ten years were pointed out. This will be the subject of a communication to the Research Committee.

The President proposed a vote of thanks to the Transvaal Institute for its hospitality to the section, and more especially to the Principal, Prof. Hele-Shaw, who had taken much personal trouble to alter the lecture-room and lantern arrangements to suit the requirements of the meetings. A special vote of thanks was also passed to all the South African officers of the section, and especially to Mr. F. Flowers, one of the secretaries, who was responsible for the local arrangements, both at Cape Town and at Johannesburg.

PAPERS OF GEOGRAPHICAL INTEREST IN OTHER SECTIONS.

SECTION A.—It was at one time hoped that a joint meeting of the Physical and Geographical sections might be arranged, to hear the papers on surveying. In addition to those read in Section E, they included Sir David Gill's account of the "Progress of the Great African Arc of Meridian and Geodetic Survey" (at Johannesburg), Profs. Beattie and Morrison's description of the "Magnetic Survey of South Africa," Dr. Backlund's paper on "Geodetic and Gravitational Observations in Spitsbergen," and Mr. H. G. Fourcade's on "Stereoscopic Surveying."

Two meteorological papers were also read in Section A. Dr. Mill's "Comparison of the Periodicities of Meteorological Records at London and Cape Town," and Mr. R. F. Rendall's "Meteorological Notes from the Natal Observatory."

Prof. Milne's report and paper on "Recent Advances in Seismology" involved interesting geographical problems.

SECTION C.—In addition to the papers read at the joint meeting, a number of papers were of considerable interest to geographers. Among these the descriptions of the geological condition of Cape Colony, by Mr. A. W. Rogers, the Government Geologist; of Basutoland, by Mr. S. S. Dorman; and of South Victoria Land, by Mr. H. T. Ferrar, may be mentioned.

It was unfortunate that Prof. Sollas's suggestive paper on the "Continent of Africa in Relation to the Physical History of the Earth" could not be read at the joint meeting. At Johannesburg the Geographical section met an hour later on the Wednesday, in order to hear Mr. Lamplugh's "Report on a Traverse of the Zambezi Gorge," which was illustrated by many excellent views. In it he confirmed and supplemented the account of Mr. Molyneux which appeared in the *Journal* for January, 1905.

At Cape Town Prof. A. Young described a remarkable tidal movement which he had discovered in the underground waters of the

Karroo. If this is an indication of a vast subterranean water system at depths which can be reached by bore-holes, it is of great economic importance.

SECTION D.—Mr. W. L. Sclater's paper on the "Migration of Birds in the Southern Hemisphere" was the one of greatest geographical interest.

SECTION F.—Many economic papers necessarily involved geographical considerations, and must be read by those specializing in economic geography. The three read at Cape Town on the Friday were of this nature, viz. Mr. T. H. Moore, on the "World's Supply of Wool;" Mr. A. L. Bowley, on the "Changes in the Sources of the World's Wheat Supply since 1880;" and Mr. E. Nobb, on "The Food Supply of Cape Colony." Such papers as Sir David Hunter's "Development and Working of Railways in Natal" and Mr. R. à Ababrelton's "Colonial Lands of Natal" involved important geographical considerations.

SECTION I.—It is not common to find in the proceedings of the Physiological Section papers of special geographical significance, but at Cape Town Sir Lander Brunton opened a most interesting and valuable discussion on the relations of climate and health, in which many distinguished physicians took part. This is in part a geographical problem, and we understand that geographical representatives will be asked to join the committee which has been formed to collect and discuss the existing data on this subject.

SECTION K.—Three valuable communications were contributed on plant geography. Prof. A. Engler, of Berlin, discussed the "Vegetations and Floral Elements of Tropical Africa," Dr. R. Marloth the "Phyto-geographical Subdivisions of South Africa," and Mr. J. Burtt-Davy the "Life Zones of the Transvaal, their Climate and Crops."

Evening Lectures. — Two evening lectures were on geographical topics. Mr. Douglas Freshfield discussed the subject of mountains at Durban, but an unsatisfactory lantern prevented his beautiful slides being properly shown. Mr. Ferrar, by special request, gave an account of the National Antarctic Expedition in Pietermaritzburg, his native town. Mr. Randall MacIver's report on the Rhodesian rivers, which was read at Bulawayo, will be the subject of a communication to the *Journal.*

Committees.—The recommendations of the Committee of Section E were all accepted by the Committee of Recommendations and by the General Committee. These included the continuance of the existing committees for the exploration of the West of the Indian ocean, and for collecting local names for topographical and geological phenomena (jointly with C). Along with Sections B, C, and G a new committee was recommended to investigate the "Quantity and composition of rainfall and of lake and river discharge." *

* Information which would be of use to any of these committees, or to that on Climate and Health, should be sent to the secretary of the relevant committee, British Association, Burlington House, London, W.

PRELIMINARY REPORT ON THE PHYSICAL OBSERVATIONS CONDUCTED ON THE NATIONAL ANTARCTIC EXPEDITION, FROM 1902 TO 1904.*

By L. C. BERNACCHI, F.R.G.S.

ONE of the principal scientific objects of the National Antarctic Expedition was a magnetic survey of the south polar regions of the globe.

The magnetic survey of 1843–1849, conducted at sea under Sir James Ross, with fixed observatories established at Toronto, St. Helena, Capetown, and Hobart, formed one of the most valuable contributions to our knowledge of terrestrial magnetism, and enabled Sabine to construct maps of equal lines of magnetic declination, inclination, and intensity for the whole world, for the completion of which every available observation made up to 1870 was employed. From 1870 to 1880 was a period of activity in magnetic observations on sea and land, and the magnetic charts published in the report of the scientific results of H.M.S. *Challenger* give a fairly accurate representation of the normal distribution of the Earth's magnetism between parallels 70° N. and 40° S. for the epoch 1880; but beyond these limits there is a considerable degree of uncertainty, especially in the southern regions south of 50° S., where we have very few observations since 1845, and where the changes in the magnetic elements during the last sixty years have been considerable.

Of recent years elaborate magnetic surveys have been conducted in various parts of the world, and with splendid results, but it has proved almost impossible to establish and maintain a theory of terrestrial magnetism unless observations in the Antarctic Regions were carried out. All calculations, however excellent, must necessarily fail if that gap in our information is lacking; thus the completion of the theory of the Earth's magnetism remained an unsolved problem. The necessity of a survey of the magnetic constants, changes, etc., within the Antarctic circle therefore became essential in its importance with regard to the advancement of our knowledge of terrestrial magnetism. Whether the magnetic observations of the *Discovery*, taken in a high southern latitude, when combined with observations of other expeditions and land stations will materially advance our knowledge remains to be seen; certainly they cannot fail to throw considerable light on the magnetic conditions of the Antarctic Regions.

In this preliminary paper no attempt has been made to give results, but only to give some indication of the magnetic and other physical work carried out, more especially while the *Discovery* was frozen in from February, 1902, until February, 1904. An attempt to deal with so large a mass of observations both on land and sea at this early date would only lead to confusion, and therefore conclusions here put forward must be accepted with considerable reserve.

Besides the Fox and Lloyd-Creak instruments for the determination of inclination and total force at sea, the *Discovery* was supplied with unifilar magnetometers and barrow-circles for the determination of absolute declination, horizontal force, and inclination on shore, and with a set of Eschenhagen variometers or self-recording

* Research Department, May 8, 1905. Mr. Bernacchi said: I should like, before I read this paper this afternoon, to ask you to understand that the paper was written some months ago, before any attempt was made to reduce the physical work of the *Discovery*. Therefore any results put forward in the paper must necessarily be accepted with considerable reserve. Some of the observations, I understand, have already been reduced, but I have not had access to the results, therefore I cannot put any definite results before you this afternoon.

instruments for obtaining a continuous photographic record of the changes in declination, horizontal force, and vertical force.

Some time previous to the departure of the British and German expeditions, a scheme of international co-operation in magnetic work was established, and besides the continuous observations with the variometers, regular term days and term hours were agreed upon for obtaining special observations with them at the same moment of Greenwich mean time.

The southern stations co-operating were New Zealand, Melbourne, and Mauritius. The Argentine Government sent a party to Staten island, near Cape Horn, and Germany one to Kerguelen island; in the northern hemisphere, Kew, Falmouth, Bombay, and German and other foreign observations. The magnetic observatory at Christchurch, New Zealand, was made the primary base station of the expedition in the southern hemisphere, and here the constants for our instruments were determined before sailing in 1901, and again on returning in 1904. Our thanks are due to the New Zealand Government for their courtesy in placing the observatory at our disposal, and to Dr. Coleridge Farr and Mr. H. F. Skey, of the observatory, for their valuable assistance.

With the sea observations it is not our purpose to deal in this paper, but exclusively with the physical work conducted from February, 1902, to February, 1904, on shore.

As soon as a suitable winter spot was found for the *Discovery*, a site was selected for the magnetic observatory. From a magnetic point of view, an observatory of this kind should be placed in a position where conditions are not disturbed by the presence of magnetic rocks; but it would be difficult, if not impossible, in the whole length of Victoria Land to find such an undisturbed locality, unless it were on the surface and near the edge of one of the extensive ice-flows far from the actual coast-line, such as the Great Ice Barrier or the ice-flow in the vicinity of Lady Newnes bay.

The spot selected for the observatory (lat. 77° 50′ 50″ S., long. $11^{h}\ 7^{m}\ 0^{s}$ E.), although the best available, was hardly an ideal one for magnetic observations. It was on the extremity of a peninsula extending in a south-west direction from the base of an island formed by Mounts Erebus and Terror. Length about 10 miles, and breadth 1 mile, and average height about 800 feet. The extreme end, however, where the observatory was placed was only between 30 feet and 50 feet above sea-level. The geological formation is of a volcanic nature, principally basalt, and, as will be seen later, had considerable influence on the absolute values of H.F., V.F., and inclination. As soon as the *Discovery* reached her winter quarters (a small inlet to the south of the end of the peninsula), the observational huts were immediately landed, and erection commenced. These huts were constructed of large asbestos slates, screwed on to the outside and inside of a wooden framework. The larger of the two, used for the variation house, was 11·6 feet by 11·6 feet, and 6·8 feet in height. The absolute house was slightly smaller.

Although, perhaps, small log huts would have been more suitable, they certainly would not have been so light, compact, and easily portable. The asbestos huts were, on a whole, fairly satisfactory, but had some grave disadvantages.

By the end of February, 1902, the erection of the variation house (A) was completed, and the variometer set up and working for the term day, March 1st. The absolute house (B) was completed later, and placed 25 yards to the north of (A). Both huts were 30 feet above sea-level. For the absolute instruments a brick pillar was built up through the floor of B, 3 feet 6 inches above it, and 2 feet by 1 foot 6 inches square. The door of the hut faced nearly due west, and narrow openings were made across the roof and down the north and south walls in, as near as possible, the geographical meridian, for the purpose of using a transit instrument or theodolite. An azimuth peg was erected a little to the south of west, 30 yards from the observational pillar. The peg was an iron one, driven into the frozen ground to a considerable depth, and only 1 foot showing above the surface. At the top was a circular hole, across which a wire was stretched and a light placed behind when bearings were taken from the hut in the dark winter months.

For the variometers in A, a bench was erected in the magnetic meridian, 8 feet 5 inches in length and 1 foot 6 inches in breadth, supported at one end by a drain pipe 1 foot 6 inches diameter sunk into the frozen ground, and at the other extremity a thick pillar of wood sunk in the same way. The thickness of the wood slab forming the bench was 3 inches, and was 2 feet 9 inches above the ground.

The latitude of the observatory is the mean of a large number of meridian and circum-meridian altitudes of the sun, taken during the summers of 1902–1903 and 1903–1904 with theodolite and sextant. Until all these observations have been re-worked and checked it is probably a few seconds in error. The longitude is that derived from a few occultations of stars by the moon, and until re-worked is, probably, also slightly in error.

The azimuth of the fixed mark for declination observations was first determined by theodolite in May, 1902, and subsequently by a number of sun azimuths in the spring and summer of 1902–1903 and 1903–1904, using the azimuth mirror of the magnetometer and finding the mean time at place by altitudes of the sun in a mercury horizon.

As soon as possible the absolute values of declination, horizontal force, and inclination were determined, the instruments employed throughout the two years being the same, viz. unifilar magnetometer No. 25 by Elliott, and inclinometer No. 27 by Barrow. All the magnets were adjusted in their stirrups for the latitude, and during the first two months magnet 25 D was employed in determining the horizontal force, but as the value of P. for this magnet was found to be normally negative, this was changed for 25 A, which was subsequently used throughout.

The method of observation was the same as that employed at Kew and other observatories, the only difference being that, instead of distances 30 and 40 cms. in the deflection experiment, 42 and 56 cms. were used, owing to the small size of the force. The approximate value of the declination was found to be 152° E., H.F., 0·06 C.G.S. unit, and dip −84° 40′. The reduction and publication of the absolute observations has been undertaken by the Hydrographic Department of the Admiralty.

The changes in the values, especially declination and horizontal force, are so rapid and irregular that little can be gathered from individual observations. It is only by examining the main position of the curves on the magnetograms from month to month that the changes can be clearly detected. However, I think it will be found, when these observations are published, that there is an indication of a large *annual* variation in all the elements. This, we shall see later, is more clearly indicated on the magnetograms.

The declination reaches a maximum easterly value towards the time of the autumnal equinox (September), or a little later, and a minimum near the vernal equinox (March), the annual range being about 2°. The horizontal force increases towards the autumnal equinox, and decreases towards the vernal, the range being approximately, 0·001 C.G.S.; while the dip decreases towards the autumnal and increases towards the vernal equinox, the range in 1903 being nearly 30′.

Magnetically disturbed days, especially in the summer, were very frequent. It was only on a few days in each month that good absolute observations were possible. It was not always easy to select quiet days. Frequently attempts at absolute observations had to be abandoned on account of too great disturbance, and, in the winter, sometimes on account of a blizzard, which made intercourse between the ship and the shore, and observing in the small exposed absolute house, almost impossible. In November, 1903, a large tent was erected on the unbroken sea ice in McMurdo strait, 2 miles from the nearest shore-line, and over a spot where the depth of water was 220 fathoms. Three sets of observations were taken, viz. on November 4, 6, and 8, with an interval of two days between each set. The variometers were running simultaneously. The results obtained were rather surprising. The following table shows the results of the observations of November 8 compared with those taken on shore on November 2:—

TABLE I.

Date.	Horizontal force.	Total force.	Vertical force.	Inclination.
	C.G.S.	C.G.S.	C.G.S.	° ′ ″
Nov. 2, on shore	0·06929	0·7306	0·7273	84 33 6
Nov. 8, on ice ...	0·04367	0·6982	0·6968	86 24 8
Differences ...	0·02562	0·0324	0·0305	1 51 2

From the mean of all three sets a correction can be found to apply to the observations taken on shore. Unfortunately, at this time persistent overcast weather prevailed, and no observations of declination were possible on account of there being no sun visible for the determination of a true bearing. This was not done until January 30, 1904, and was then found to be 152° 43′ 52″ E. at 3^h 39^m p.m. local mean time, the declination on shore for that time, taken from the magnetograms of January, being about 152° 40′ E. Thus the declination seems little affected by the magnetic character of the rocks.

The establishment of the absolute house out on the sea ice, although, perhaps, possible during the second year, would have been attended by considerable difficulty and some risk, especially as it would have been fully exposed to the heavy winter storms, and the surface of the ice, being hard and smooth, offered very little holding ground. During the first year practically nothing was known of the ice-conditions in the strait; indeed, up to quite late in the year the ice within a few hundred yards of the ship was continually breaking up and drifting away.

The tent on the ice was made the base station for the observations taken on the Ice Barrier sledge journey of November 10 to December 10, 1903, with inclinometer No. 27 by Barrow, having two reversible inclination needles and two total-force needles.

The objects of the Ice Barrier sledge-journey were to determine the extent of the ice-sheet which is terminated by the Great Ice Barrier in a direction due south-east from Mount Erebus; to ascertain, if possible, whether land existed in that direction; to take a series of magnetic observations where they would probably not be disturbed by magnetic rock masses; to investigate the surface of the barrier in detail, and the meteorological conditions prevailing over this ice-sheet during the summer months.

The farthest point reached was about 155 geographical miles south-east of Mount Erebus, the total distance traversed being about 340 statute miles. Constant south-west winds with drifting snow were experienced. The geographical positions of the "camps" were determined, whenever possible, by means of sextant observations of the sun in an artificial mercury horizon.

With the exception of those taken on November 28, all magnetic observations were taken in the evenings between 7 p.m. and 9 p.m. after the day's march. On two occasions only was it possible to observe in the open air. In most cases the strong cold wind with drifting snow prevented open-air observations, and they were then taken in the small, low sleeping-tent while the other two occupants waited outside. The following are some of the results obtained:—

TABLE II.

Date.	Camp.	Latitude.	Longitude.	Inclination. Mean 2 needles.	Total force.
		° ′ ″	h. m. s.	° ′ ″	C.G.S.
November 8	Base	77 50 50	11 7 0 E.	−86 24 84	0·6982
„ 14	E	78 6 0	168 26 0 E.	−86 0 0	0·6694
„ 17	H	78 33 0	170 22 0	−85 45 39	0·6487
„ 20	M	78 50 0	172 1 30	−85 27 70	0·6166
„ 23	P	28·5 geo. miles	S.E. of M	−85 4 22	0·6031
„ 26	S	50·0 geo. miles	S.E. of M	−84 58 83	0·5881
„ 28	W	79 33 0	175 55 30	−84 49 31	0·5855

The above observations are very uniform, and with the exception of an observation taken on the return journey close under a small volcanic island called "White Island," which has been rejected on account of showing slight disturbance, they do not seem to be at all influenced by land-masses. The decrease in the inclination over 155 geo. miles is 1° 35′ 53″, or about 1′ for each 1·6 geo. mile. The total change in the total force amounts to 0·1127 C.G.S. units. The total force has been found by the formula given in the Admiralty 'Manual of Scientific Enquiry.'

These observations ought to give a capital idea of the rate of change over an apparently undisturbed area in these latitudes, and may be of some assistance in more accurately locating the position of the south magnetic pole. Besides observations for inclination and total force, the declination was observed by means of a prismatic compass, but these have not yet been worked out excepting very roughly while on the march.

Declinations were also observed by Captain Scott on his southern and western sledge-journeys, and ought to prove of considerable value. On the western journey the isogonic of 180° was crossed in about lat. 77° 50′ S., long. 155° E. during the months of November and December, 1903.

The self-recording variometers supplied to the expedition were the delicate transportable type devised by the late Prof. von Eschenhagen, and made by the firm of O. Toepfer, of Potsdam. They consist of a declinometer, a horizontal and a vertical force magnetometer, and self-recording apparatus. These instruments, especially the first-named two, possess several advantages over the instruments used hitherto, but are almost too fragile and sensitive for use at a polar station.

The magnets for the declinometer and H.F. instruments consist of well-hardened laminar pieces of watch-spring steel, 25 mm. in length and weighing about 1·5 gramme. A light aluminium frame supports the mirror and the magnet, and this is hung by means of a double hook on a small cross-piece attached to the bottom of a quartz fibre suspension. The declinometer gave entire satisfaction throughout the two years. Unfortunately, the quartz fibres supplied for the horizontal force instrument, instead of being about $\frac{1}{10}$ to $\frac{1}{20}$ mm. thick, were very much finer, being galvanometer fibres, and therefore made the magnet more sensitive than was desirable or convenient.

The vertical force instrument was a modification of the Lloyd balance, and as it was only just completed before leaving England, very little was known of its behaviour even at Potsdam. This instrument was a source of constant trouble. The needle was balanced for a dip of about 70° N. The magnetic dip at Winter harbour being about 84° S., the pull on the south end of the needle could not be overcome by the small weights and magnets supplied for the purpose, and therefore additional weights had to be added to the north end, which increased the temperature coefficient of the balance.

The principal advantage of the recording apparatus is that all three elements, base lines, and a temperature curve are on the same photogram for the day. In the summer-time, however, when the movements of the magnets are large and frequently highly disturbed, this leads to confusion.

The following is the arrangement of the instruments in the magnetic meridian: North extremity, the recording cylinder; at about 120 cms. from the cylinder, the declinometer; then the H.F. instrument at about 165 cms., and at the south extremity the V.F. instrument.

During the first year the walls of the variation house were banked with snow, and a large brass heating lamp kept burning within, so as to maintain as uniform temperature as possible. This lamp was frequently a source of danger and inconvenience of a most aggravating nature, and required constant watching; nor was it successful in keeping a uniform temperature, and giving out a fair proportion of heat for the amount of oil burned. It was altogether an unsuitable type. During the second year the house was entirely buried under snow, and although at times the temperature within was very low, viz. $-30°$ Fahr., it remained fairly uniform from month to month.

From May, 1902, until January, 1904, the declinometer was never interfered with, nor its zero mirror altered.

During the first year the H.F. instrument was two or three times found to be out of adjustment and altered, but remained untouched during the second year, while the V.F. instrument was altered from time to time during both years.

The following are approximately the scale values employed, equal to 1 mm. of the ordinates of the curves:—

$$D = 1'{\cdot}4 \text{ per millimetre.}$$
$$H = 0{\cdot}000015 \text{ dyne per millimetre.}$$
$$V = 0{\cdot}00016 \text{ dyne per millimetre.}$$

V is about the sensitiveness recommended in the international programme, but H is much more sensitive. The sensitiveness of V remained fairly constant throughout, excepting once or twice when, for a short time, it was purposely made more sensitive. It remained fairly constant during the second year, but altered a few times during the first.

The method of determining the sensitiveness was by deflecting the magnets with one of the unifilar collimating magnets at certain known distances, and then carefully finding the moment of the deflecting magnet by a set of absolute observations. If M be the moment of the magnet deflecting, d the distance employed, and E the amount of deflection, then the sensitiveness is found as follows:—

$$\left[\frac{2M}{(d^2 + E^2)^{\frac{3}{2}}}\right]$$

The only method employed for determining the temperature coefficient of the magnets was by taking sets of absolute observations while the temperature in the variation house was comparatively high, then allowing the temperature to fall rapidly and taking another set of absolute values; but as the movements of the magnets are so large and rapid, this method is not altogether satisfactory, and perhaps the best method is to compare the curves on days when the temperature is high with those when the temperature is low.

The determination of the temperature coefficient for V by this method should present no difficulty, but for H it will not be so easy, as the coefficient for this short, light magnet is so small.

Prof. Eschenhagen gives the temperature coefficient for one of his uncompensated variometers as amounting to 7γ for $1°$ C.

During the first year the curves are much finer and sharper than during the second, on account of a more sensitive bromide paper being employed, and consequently a smaller light slit. The magnetograms were usually developed once a week by means of ortol-soda developer, which has the advantage of being exceptionally clean to use, and giving rich dark tones to the curves.

On the international term days (1st and 15th of each month) the recording cylinder was run at high speed with a very wide time scale, viz. 48 cms. in two hours. The high speed was continued for about half the term day, the other half being the usual slow run, or 48 cms. in twenty-four hours.

Towards the end of the second year the supply of recording paper became very short, and from the end of September had to be distributed equally over the following months, amounting to about a week in each month. This is the only serious break in the two years' record. In all there are records for about six hundred days.

On casually looking through all the records, the first thing to impress one is the extreme disturbed nature of the curves. On only a few days of the year, and these almost entirely during the winter, do they really deserve the name of quiet. Secondly, the large diurnal variation in the spring and summer months. Thirdly, the conspicuous difference of the mean distance of the curves from their base lines from month to month, or, in other words, the annual variation.

The movements of the magnets, especially in summer, are so sudden and large, being in the form of peaks and hollows, as at times to move well beyond the range of the recording cylinder, and therefore on very disturbed days considerable portions of the curves are lost.

It will be seen, on examining the records, that some of these sudden movements, especially in the H.F., occur at approximately the same time on a number of consecutive days without any apparent cause. Generally speaking, a large movement of this kind will take place nearly simultaneously in all three curves, but sometimes only in one, with little or no indication of it in the others.

On returning to New Zealand, a rough comparison between one or two of our records was made with those of Christchurch observatory, and it was clearly seen, especially on the records of June 28, 1903, that some of the larger peaks and hollows were almost simultaneously produced at Christchurch, but to a much smaller extent. Whether the direction of the disturbances was the same we did not examine. Some of the most disturbed days at Christchurch and at Kew are also some of our most disturbed ones, such as April 10, 1902, and November 1, 1903, which appears to have been a disturbed day over a large portion of the globe.

The following were some of the most disturbed days during the year 1902:—

March 16, 17.*
April 9,† 10,*† 11,† 20.
May 8, 9,† 10.†
June 1,† 26, 27, 29.
July 8,† 24, 25.
August 21, 22, 24.
September 2, 20,* 23.
October 22, 29, 30, 31.*
November 13, 14, 15, 16, 17, 18.

* Very disturbed days. † Aurora observed.

The curves for December of both years, and for January and February, are so confused and disturbed that it is quite impossible to tell an unusually disturbed day from a moderately quiet one. Measurements of the curves for December and January especially will present many difficulties, the movements are so rapid, have crossed and re-crossed so frequently, and in many cases are lost, being beyond the range of the recording cylinder.

A careful record of all the auroræ seen during 1902–1903, has been kept, but a comparison between the times of auroræ displays and the curves for the same time has not been made, excepting in a very cursory manner. Although auroræ were observed on some disturbed magnetic days, there were days when curves were not *abnormally* disturbed when compared with curves on days when no aurora was seen.

On July 3 and 4, 1902, a comparatively bright and extensive aurora, which continued for a number of hours, was observed, but the curves for those hours are *less* disturbed than usual. There is, however, some indication of a sudden large disturbance, especially in the H.F., a little before the commencement of an aurora display, but this may be a mere coincidence.

The following tables give a very approximate idea, for the year 1903, of the mean diurnal variation for each month, with the mean times of maximum and minimum, also the change of the mean position of the curve from its zero from month to month, or, in other words, what appears to be the amount of annual variation. Only values for declination and horizontal force are here given, and are obtained from the four quietest days in each month. The values for November, December, and January are only partly given; the curves are much too disturbed to obtain approximate values from a few measurements. The determination of even approximate values of vertical force would involve considerable labour, as the base values have been so frequently altered and the temperature coefficient is so large.

TABLE III.

Month, 1903.	Mean daily range.	Mean time of maximum.	Mean time of minimum.	Horizontal force in C.G.S. units.	Mean time of maximum.	Mean time of minimum.
	° ′	h.	h.			
February	1 23	9 a.m.	7 p.m.	0·00085	5 a.m.	4 p.m.
March	0 58	8 "	6 "	0·00061	7 "	2 "
April	0 36	7 "	7 "	0·00038	6 "	3 "
May	0 30	8 "	7 "	0·00033	4 "	4 "
June	0 22	7 "	6 "	0·00020	5 "	3 "
July	0 38	6 "	4 "	0·00038	5 "	3 "
August	0 48	8 "	4 "	0·00040	4 "	3 "
September	1 30	7 "	5 "	0·00074	4 "	3 "
October	2 8	7 "	7 "	0·00093	7 "	2 "
November	1 42	6 "	5 "			
December	1 27	8 "	5 "			

TABLE IV.

Month, 1903.	Mean position of D curve.*	Mean position of H.F. curve.
	′ ″	C.G.S.
February	+ 2 2	0·00024
March	− 5 7	0·00030
April	+19 0	0·00035

* By mean position, of course, is meant its mean distance from its base line given in its own scale value.

TABLE IV.—*continued.*

Month, 1903.	Mean position of D curve.	Mean position of H.F. curve.
May	26 3	0·00052
June	46 7	0·00069
July	60 3	0·00076
August	80 3	0·00090
September	106 6	0·00104
October	127 0	0·00106
November	103 6	0·00090
December	84 0	

An examination of the above tables shows that the diurnal variation in declination attains a maximum towards the end of September or beginning of October, being then over 2°, and then gradually decreases, until at about midwinter (June) it is a minimum, being then only 22′. However, the two values given for November and December are very approximate, and when all the curves for these respective months have been measured, the daily range may prove to be somewhat greater. The daily maximum and minimum occurred approximately at the same time in each month—that is, within two or three hours—the mean time of maximum declination being about 8 a.m., and of minimum about 6 p.m.

The annual variation shown in Table IV. is about 2°, the minimum value being in March and the maximum in October. The total annual range in horizontal force is about 0·001 C.G.S. unit, the maximum being in October and the minimum about February.

The largest diurnal range in H.F. is in October, or perhaps a little later, and the smallest in June. The times of maximum and minimum are about three hours earlier than in the case of the declination, being about 5 a.m. for maximum and 3 p.m. for minimum.

At present nothing can be said definitely with regard to the secular change. There is some sign of a secular increase in declination and horizontal force and decrease in inclination, but to what extent it is impossible to tell until the whole of the two years' record has been reduced.

There are many problems of deep interest in connection with these photographic records, but which it is impossible to even attempt to deal with here. Such, for instance, are the minute and regular magnetic waves or oscillations clearly shown on some of the H.F. curves obtained on term days from the high-speed cylinder. Some of these waves are very sharp and well defined, and have a period of about eight seconds. Whether these small movements occur simultaneously at New Zealand and more northern stations it will be interesting to compare. On September 21, 1903, there was a partial eclipse of the sun at Winter harbour. The times of contact and position, angles and magnitude, were carefully calculated, and an observational programme prepared. The time of eclipse was from $3^h\ 40^m$ p.m. M.T. to 5.37 p.m.—duration $1^h\ 57^m\ 14^s$, and magnitude 0·94. Unfortunately, thick, overcast weather prevailed during the afternoon, and not a glimpse of the sun was seen. During the time of the eclipse a high speed record was obtained on the magnetograph. Whether a magnetic effect referable to the eclipse will reveal itself remains to be seen.

The only other magnetic observations on land that remain to be mentioned are a set of dips and total force taken at Cape Adare in January, 1902, and again in 1904, and a set of dips and total force at Cape Crozier in January, 1902. The values obtained at Cape Adare are practically the same as obtained in 1899, and show little sign of secular change. The observations at Cape Crozier are largely effected by the magnetic character of the rocks. During February of 1904 the *Discovery* endeavoured to penetrate into Wood bay for the purpose of getting magnetic observations on shore, or on fast ice removed from the shore at the bottom of the bay and as close to the magnetic pole as possible, but the attempt had to be abandoned on account of the bay being packed with heavy close ice.

During the year 1900 a set of magnetic observations were taken on shore in Wood bay by the Southern Cross Expedition, and gave an inclination of 88° 2′, but as the volcanic character of the rock there is much similar to that at Winter Quarters, it is possible that this value is too small, and that Wood bay is closer to the magnetic pole than this would indicate—probably as much as 88° 53′ in December and 89° in February. The observations taken on board the *Discovery* in Wood bay, when reduced, may throw some light upon this matter.

A sledge journey from Wood bay in the direction of the magnetic pole may be attended by considerable difficulties on account of the lofty mountain ranges that may have to be crossed, but at Lady Newnes bay, about a degree further north, the mountains are comparatively low, and entirely snow-clad. A journey to the magnetic pole from here might be successful, especially during the summer months of December, January, and February, when the temperatures are such as permit the handling of magnetic instruments without undue inconvenience.

Auroral Observations.

A record of the auroræ visible during the two winters 1902–1903 was kept. The observations were generally made by the officer who was on meteorological duty for the night—a duty in which all the members of the *Discovery's* wardroom participated.

Ordinarily, the observations consisted of noting the time, position of the auroræ, both altitude and amplitude, its intensity, form, movement, and duration. These observations were entered in a special journal kept for the purpose, and a chart of the surrounding hills was supplied each night for drawing in its position with regard to the magnetic meridian, etc. Whenever the display was fairly extensive, the physicist was called and special observations taken, such as photometric measurements of its intensity, spectroscopic, atmospheric electricity and width of bands, altitudes, and times of special movements.

On a whole the displays, although very frequent, were extremely poor, and were generally in the following forms:—

1. Faint lights, with no defined forms.
2. Luminous patches which frequently presented the appearance of clouds.
3. Incomplete arches or segments of arcs, of which the brilliancy was not uniform nor the border regular. From these arches rays would frequently shoot up intermittently.
4. Rays or vertical shafts separated from each other at a greater or less distance.
5. In one or two exceptional cases irregular bands formed of rays or vertical shafts pressed close together and forming "draped auroræ."

The faint lights and luminous patches were of the most varied dimensions, sometimes very small, and at other times occupying almost the whole of the eastern sky. Their brilliancy was rarely much more intense than that of stars of the 4th magnitude, or even the Milky Way. They formed as if it were a white veil over the sky, through which stars of small magnitude were plainly visible. A clearly defined arch, formed of a homogeneous luminous mass touching the horizon at both extremities, was rarely seen.

From the middle of the moon's first quarter to the middle of its last quarter the auroræ were generally quite invisible. Spectroscopic observations of the auroræ were not successful, due, apparently, to the weak intensity of the light. On some occasions the characteristic yellow line near D was seen by means of a direct-vision spectroscope, but although plates were exposed night after night in the prismatic camera, the times of exposure varying all the way from a few minutes to twenty-four hours or more, not the slightest trace of the spectrum could be discovered on developing the plates. The spectrum plates (Cadet) appeared to be in fairly good condition, good photographs of the spectrum of Kryptom gas, and of the sun and atmosphere having been obtained on them.

The observations of atmospheric electricity taken during the displays reveal no special effect referable to the aurora.

The following tables give (1) the number of days in each month when auroræ were recorded; (2) the daily period of the aurora, with its mean altitude.

TABLE V.

Year.	March.	April.	May.	June.	July.	August.	September.	Total.
1902	—	10	8	14	11	10	3	56
1903	2	19	14	16	17	14	2	84
Days	2	29	22	30	28	24	5	140

TABLE VI.

		P.M.						A.M.				
	0h.	2h.	4h.	6h.	8h.	10h.	12h.	2h.	4h.	6h.	8h.	10h.
March	—	—	—	—	—	—	2	1	1	—	—	—
April	—	—	—	—	1	0	3	5	1	0	0	0
May	—	—	—	—	3	2	0	1	1	5	0	0
June	—	—	—	—	1	0	4	3	6	5	8	2
July	—	—	0	1	6	5	9	11	10	9	4	2
August	—	—	1	1	4	3	7	8	7	1	0	0
September ...	—	—	0	0	0	0	0	0	0	0	0	2
Mean	—	—	9	2	15	10	25	29	26	20	12	6
Mean altitude	—	—	—	—	9°	12°	17°	19°	30°	15°	23°	13°

An examination of the above tables show (1) that the largest number of auroræ occur during the winter months, June and July, and that there is some indication of May being relatively a quiet aurora month in both years; but this may be purely an accident. The small number observed in March and September is, of course, due to the large amount of daylight. Although Table VI. is not strictly accurate, only the observations of one year having been used, the daily variation of the aurora at Winter harbour is clearly shown, the maximum occurring at about 2 a.m., which is also about the time of the mean maximum altitude of the display. The time of maximum appears to depend upon the latitude, it being later as we go towards the pole. Thus at Cape Adare (71° S.) it is about 9 p.m., and on the *Belgica* Expedition (71° S.) also about 9 p.m. The aurora with us usually appeared first at about 4 p.m., low down on the horizon, and gradually moved up towards the zenith, reaching a maximum at about 4 a.m.

There are many points of interest, such as the intensity periods, the monthly period due to the moon's phases—the magnetic direction of auroræ at different hours of the day—simultaneous appearance of auroræ with those at northern stations, and with sudden outbreaks of solar spots; its relation with terrestrial magnetism and meteorological phenomena, etc.

With regard to the direction of auroræ at Winter harbour, it is interesting to note that displays were almost exclusively confined to the eastern sky, which was also the direction from which the prevailing winds blew. Auroræ were seldom seen in the west. Arches and segments of arcs at right angles to the magnetic meridian (N.) were frequently recorded.

A number of observations have been made by Antarctic expeditions since 1897, and when all these have been published and tabulated, some light may be thrown upon the geographical distribution of the aurora in the southern hemisphere.

Seismic Observations.

The Milne seismograph supplied to the expedition was erected at Winter harbour in the variation house during March, 1902. This instrument (No. 37) was made by R. W. Munro, London, of non-magnetic materials. The drain-pipe upon which the bed-plate was lightly fixed was 1 foot 6 inches in diameter, and was sunk down through a thin layer of ice until it rested upon a solid bed of frozen earth and stones. The height of the pipe above the ground was 19½ inches. When the column had been made rigid, with bed plate attached, the instrument was set up in the geographical meridian, the aluminium boom being N.—S., and the balance weight and attachment of tie at the regulation distance from the pivot, viz. 7 mm. and 125 mm. respectively. By means of the pivot and front leveling screw the boom was given a period of exactly 15 seconds. When deflected 8 or 9 mm. from its normal position, it took about 8 minutes before returning to rest. The instrument was kept going in this position from March 26 to November 9, 1902, when it was dismounted, removed to the large living hut, and erected on a masonry pillar (brick) of following dimensions:—

Depth sunk into ground	12 inches.
Height above ground	3 feet.
Breadth	2 feet by 2 feet.

The instrument was so placed that the boom pointed S.—N. true; thus in an opposite direction to its former position. The period of the boom was made exactly fifteen seconds.

From January 29 until March 18, 1903, the seismograph was dismounted, the brick pillar being then employed for pendulum work, and was finally dismounted in December, 1903.

The seismograms procured over the two years show remarkably few tremors (136 during two years).

The following are the dates on which the largest tremors were observed:—

1902.

March 28. Prolonged tremors. Also recorded in New Zealand.
April 20. Ten minutes between preliminary tremors and maximum movement.
„ 21. Seventeen „ „ „ „
May 26. Five „ „ „ „ „

Aug. 10.
Sept. 22. Fifteen minutes between preliminary tremors and maximum movement.
Oct. 6. Tremor storm, nineteen hours' duration.
Dec. 25.
1903.
April 11. Five minutes between preliminary tremors and maximum movement.
„ 29.
May 18.
„ 19.
June 8.
July 9.
Sept. 23.
„ 25.
Oct. 8.
„ 21. Twelve minutes between preliminary tremors and maximum movement.
„ 29.
Dec. 6.

The times of preliminary tremors, maxima, etc., are not here given, and in only a few cases have they been compared with the New Zealand records, such as that of September 22, 1902, where the movements on both seismograms seem practically identical, but of much smaller amplitude at the southern station. The seismic disturbances at Winter harbour were seldom large enough to appear on the magnetogram. Prolonged tremor storms, especially in October, were recorded, and well-defined pulsatory disturbances of a minute nature more frequently, especially in the winter, when a sudden fall in the outside temperature took place.

A large diurnal (?) movement of the horizontal pendulum is clearly perceptible. However, this wave movement may prove to be rather a monthly or seasonal one than diurnal. Sudden changes of barometric pressure are also clearly indicated.

It is within the bounds of possibility that manifestations of activity at a volcanic centre may be marked by a decline of the earth tremors of the district around, as though a safety-valve had been opened at that part of the Earth's surface. Certainly the fact of there being so few tremors is, perhaps, more interesting than if tremors had been large and frequent.

Atmospheric Electricity.

Observations of atmospheric electricity with the Kelvin portable electrometer were made during 1902 and 1903. During the winter months these observations were often very unpleasant to take on account of the small screws and bare parts of the small instrument, which could not be handled with mitted fingers. For a polar climate some larger instrument which does not necessitate the observer being frostbitten when using it in cold weather should be employed, or some form of self-recording electrometer.

The observations were taken on a stand about 4 feet above the ground, and away from any buildings, erections, etc. During the dark months observations were taken at 11 a.m. and 5 p.m. every day, excepting when high winds with low temperatures made it impossible. After the return of the sun observations were generally taken every two hours from 10 a.m. to 10 p.m. The direction of the wind, temperature, form of cloud, etc., was entered with the observation.

From 8 a.m. on November 22 to 8 a.m. on November 25, 1902, a series of hourly observations were carried out with the assistance of Mr. R. W. Skelton, R.N., chief engineer of the *Discovery*, and again in 1903 two hourly observations from noon on October 7 to noon on October 10.

Besides the two series of three days, observations were occasionally taken on individual days throughout the twenty-four hours in both winter and summer.

The observations during the second year are not so complete as during the first, but are supplemented by observations taken at 15 feet above the ground, immediately after the observations at 4 feet, an insulated wire from the burning match at the top of the pole to the instrument being employed for the purpose.

None of the observations of atmospheric electricity have yet been reduced and tabulated, so nothing definitely can be said with regard to them.

The difference of potential is higher in summer than in winter, and the daily range is perceptible during the summer months, it being a maximum soon after midnight and a minimum about noon. In the winter months, if a range exists at all, it must be so small as to be most difficult to measure without some type of continuous self-recording instrument.

Whenever there was drifting snow in the air or fine ice-needles, the difference of potential was very large and variable, and in many cases the electrical strain would discharge the electrometer.

Gravity Observations.

Determinations of the constant of gravity in the southern hemisphere are singularly few. Those taken by various expeditions on the Falkland, Auckland, Kerguelen, South Shetland islands, etc., and at observatories such as Melbourne, Monte Video, etc., give evidence of an accordance of facts between the northern and southern hemispheres, but the data is far from being complete.

Until 1902 observations in a high southern latitude were utterly lacking.

The Struchrath pendulum apparatus of the expedition was acquired from the South Kensington Museum, and consists of three-quarter meter invariable pendulum swung on three separate agate planes, a dummy or temperature pendulum, an air-tight case in which the pendulums are swung, flash apparatus, air-pump, and various other accessories.

It is not our purpose to describe the instrument in detail here, but to give some idea of the observations taken and the methods employed.

While at the Kew Observatory the air-tight case leaked very badly, the amount of leakage being on September 5, 1901, as much as 30 mm. per hour at an initial pressure of 60 mm. When at the Melbourne Observatory it was found quite impossible to reduce the pressure to anything like 60 mm., and leakage was so great that both there and at Christchurch the pendulums had to be swung at atmospheric pressure. The whole weight of the extremely heavy stand and case is supported by only three comparatively slender screws. The diameter of the case and rims being about 15 inches, it is evident that the unsupported metal parts between the screws are liable to "sag," and the contact between the rims is then no longer perfect. Mr. Skelton, by means of a surfacing plate, actually found this to be the case. He therefore re-surfaced both rims, which process considerably mitigated the leakage.

As the observations show, this leakage is of a uniform nature. The apparatus was set up in a small room, partitioned off from the large living hut, and the temperature within kept as uniform as possible by means of heating lamps, and was generally near zero centigrade. The pendulum stand was placed on the brick pillar used for the seismograph, and already described. The flash-box was erected on a small case filled with cement, and therefore very heavy, and which, in turn, rested on another larger case filled with heavy materials, and at a distance of about 285 cms. from the pendulum. A sidereal chronometer by Kulberg, with very small and regular rate, was used for noting the time of coincidences. When everything had been properly adjusted, the case was fitted over the pendulum, the pressure reduced to 50 or 60 mm., and the observations commenced. The arrangement was as follows: twelve coincidences observed, six right and six left; then an interval of fifty coincidences allowed to pass, and twelve more coincidences observed. During this process four readings of pressure, temperature, and arc were obtained. The pendulum was then left to swing for two hours, and at the end of that time the same observation repeated. All three pendulums were swung in this manner; on the following day the case was taken off, the pendulums reversed on the agate planes, and the whole process repeated.

Thanks are due to Mr. R. W. Skelton for his valuable assistance throughout the gravity-work. He soon made himself competent in observing, and took independent sets on each occasion that the pendulums were swung.

The pendulums were swung at Melbourne and Christchurch before the departure of the expedition from New Zealand, and again at Christchurch on returning.

The following are the dates of observations made at Winter harbour :- -

1902, July 31. Two complete sets with all three pendulums.
August 1.
1903, February 1. Ditto.
" 2.
" 6.
September 5. Ditto.
" 6.

The calculated acceleration for Winter harbour, found by the aid of Helmert's formula, $978 \cdot 0(1 + 0 \cdot 005310 \sin 2\phi)$ cms., is 982·96 cms., and a determination from a set of observations taken at Winter harbour gives 982·83 cms. However, as some of the corrections have not been applied, this value can only be regarded as very roughly approximate.

From the geologist's report on the formation of the vicinity, a determination of a correction for density of the rocks can be made.

Before the paper, the PRESIDENT said: There is no occasion to introduce Mr. Bernacchi to you, because he has already given us a very interesting paper, and he is in a position which no other human being is in, on the face of the globe, in having passed three winters in the Antarctic Regions. On the last expedition he was physicist, and we have the evidence of his commander, Captain Scott, how very assiduous and careful he was in taking these observations, and under what very great difficulties they were carried out. I will now ask Mr. Bernacchi to read his paper.

Captain CREAK: I have listened with great pleasure to the lecturer and his plain, unvarnished account of the physical observations made by the Antarctic Expedition. Naturally, being chiefly interested in questions bearing upon the magnetic observations made during the years of sojourn in those quarters, I turn to them as the subject of my remarks. Perhaps many of us who live at home at ease, or who have only made observations in comparatively temperate climates, fail to make sufficient allowance for the severe conditions of the Antarctic climate when we criticize the work done by our intrepid explorers. It is easy to ask why was not this done, or why was not that done? and generally to find fault. This I do not propose to do, but I will consider shortly the good things the *Discovery* brought home. I notice that sea observations are excluded from this paper, but I may incidentally remark that a series of ship observations, which are possibly of great value, was taken after the pack-ice was entered. If we look at the map, in the region between winter quarters and King Edward VII. Land, a series of observations were made which are practically absolute, and are especially valuable because they give us the gradual increase of dip and force in a particular line, which is very convenient for tracing out the position of the pole. They probably will eventually have great weight when the position of the magnetic pole comes to be considered. I noticed Mr. Bernacchi talked of landing at Wood bay, or some place further north, with the object of going to the south magnetic pole. But really to fix the magnetic pole properly would require a similar expedition to Captain Amundsen's in the north, and our Antarctic explorers were not prepared for a three years' sojourn for that purpose. The site for a magnetic observatory was not by any means an ideal one, being near a volcanic mountain on a basaltic formation, but it was a case of needs must. I have reason to know that an excellent series of absolute observations were made here of the magnetic elements, and then on sledge journeys from this centre. But how about the local magnetic disturbance at such a spot? It was decidedly great, and many of the observations on land journeys connected with it were more or less vitiated. A happy thought, however, saved the situation, for in November, 1903, the tent observations of the magnetic elements were undertaken on the ice in McMurdo's strait with 220 fathoms of water below the spot. I think that is one of the most valuable observations in the whole series, because it has really enabled us to reduce all the disturbed observations and get corrections for them. These observations are not only exceptionally valuable in themselves, but they formed a key to the final reduction of the sea observations I have mentioned, as well as those on land. Respecting the observations made with the variometers, it is yet very early days to say anything, but I may remark that there seems never to have been anything like a quiet day as we know it in temperate zones. The mean daily ranges of declination, observations of which element have been successful throughout, are, judging by the comparison with those made in Discovery bay in the Arctic expedition of 1875, much as might have been expected. Taking London as 1·0, the horizontal force in Discovery bay was 0·29; at the southern winter quarters, 0·24. We find that the increase of daily range is, inversely, in about the same proportion. It is to be regretted that the force variometers did not do better. The vertical force observations are a trouble everywhere, and where a large range of temperature, as in Antarctica, prevails, you must not expect too much from them. At Cheltenham, in the United States, for example, they are so particular about the vertical-force instrument that they have built a structure which practically obviates all effects of change of temperature. So I am afraid the vertical observations will suffer accordingly, especially as the reader mentions that he had to add an extemporized weight to the instrument to balance it. It had been balanced, I understand, for 70 degrees of dip instead of 84? [Mr. BERNACCHI: Yes.] I do not agree with the lecturer with regard to the instrument being too sensitive for a polar station, but he has a well-founded objection in the confusion of curves brought about by having one photogram for all the elements and temperature curve. That seems a great pity, because they have evidently, from what I have seen of the curves, very much confused them. I think that we have a lesson to learn for the future in regard to Antarctic expeditions, that we shall not only have a larger scale, but that we shall also have a photogram for each element. Like the Arctic Expedition of 1875, little or no distinct connection was observed between auroræ and disturbances, the frequency of the latter probably masking any connection if such existed. I notice, also, that Mr. Bernacchi says he took magnetic observations on the point at Cape Adare. Were they exactly on the spots occupied by the *Southern Cross* observers? [Mr. BERNACCHI: Yes.] According to that, although there is only an interval of two or three years to go upon, there seems to be very little secular change. [Mr. BERNACCHI : Practically none in the dip.] I suppose you have not noticed any seismic effects on the instruments? That would have been an important point to notice, because it has been one upon which Prof. Milne has made particular investigations. [Mr. BERNACCHI : In one case only, and not magnetically disturbed.] I am happy to say, from what I know, that the magnetic observations now are in exceedingly good hands. I am sure that Commander Chetwynd, of the Admiralty, will do his work well, and we may trust to Dr. Chree, who is an old hand at all these reductions of variometer observations, to obtain full value from them. I hope, when all this is combined with the work of foreign countries, we shall obtain a knowledge of terrestrial magnetism we never before possessed, not of the southern regions only, but of the whole world. I think this our southern expedition will be found to have contributed largely to this knowledge.

Captain CHETWYND: I think perhaps it would be as well if I were to start off by explaining the exact position in which the magnetic observations are now. The Admiralty undertook the reduction of the absolute observations among others. The use they would be put to was to obtain the base-line values for the curves of the magneto grams. The reductions of absolute observations is complete, and it therefore remains to consider the magneto grams on the base values obtained from them. In view of the more valuable results which will be got from considering magneto grams, I have not gone into the question, which may be gone into, of obtaining changes and diurnal variations and so on from the observations themselves. Whatever result is got in that way would not be of equal value with the result obtained from the curves. So far as we have got, I think I can say there is sufficient justification for the opinion of the extremely valuable results which will be obtained. The observations of the declinations on shore combine very well with those taken on board the *Discovery*, and putting them together I have been able to draw a fairly accurate chart of lines of equal variation for that district. I only say fairly accurate, because no diurnal change has been applied; when it comes to be applied, it may to some extent alter a few of the curves, but there will not be any very great difference. I shall not fly in the face of such a high authority as my friend Captain Creak, and jump to conclusions about the pole. Of course the observations for dip taken on shore, also those which Captain Creak mentioned, give a very near approximation, or they will when they have been fully considered, as to the position of the pole. And I may mention that I made an attempt myself to fix the position of it, and it seems to be rather more to the south-east than was previously supposed. This is also corroborated by the lines of declination, which is a very valuable corroboration, as they are two totally independent sources of finding it out. Mr. Bernacchi mentioned observations taken on the ice, and gave his opinion as to the value of them. They were used as the basis or base to which all the observations on board the *Discovery* were reduced. They were the standard set of observations taken as being most undisturbed. I am sorry I cannot answer Mr. Bernacchi's question as to the azimuth of the mark. I only had the paper a short time before I came here; but, speaking from memory and from one or two instances which I looked at, there is no reason to criticize his figures; except in one or two minor cases, they agree with my results.

The PRESIDENT: Does the magnetic pole appear to be to the south of Ross's position?

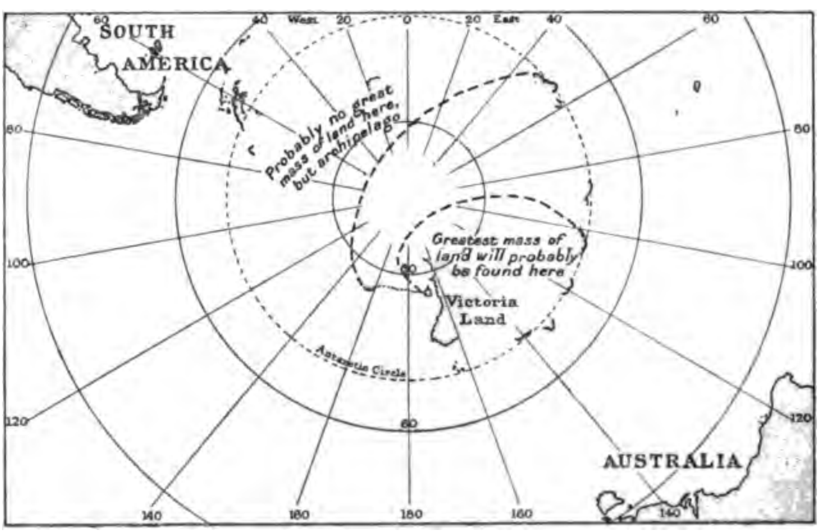
Captain CHETWYND : Yes, slightly, and it appears to be nearer Wood bay.

Mr. REEVES: Mr. Bernacchi has informed us that his paper can only be considered as a preliminary account of the magnetic observations taken during the time the *Discovery* was in her winter quarters, but I am sure that we must all feel that it is a most important one, and it is certain that the results, when finally worked out, will go a long way towards throwing additional light on the magnetic conditions of the Antarctic Regions, and the subject of terrestrial magnetism generally.

I have listened to the paper with special interest, for, as some of you may remember, about nine years ago I read a paper on this subject at one of our technical meetings in this room, in which I ventured to make certain suggestions and express opinions which I had arrived at by investigations, the general outline of which I then explained. Since that time I have had many opportunities of discussing the matter with those who have made a special study of the subject, and have found, after careful consideration, that there has been on the whole a willingness to admit that the leading points brought forward appear in the main to be correct. But perhaps what is more important is, that the explorations and observations made by expeditions in recent years tend to prove the general accuracy of my conclusions.

I have naturally followed the results of recent expeditions with great interest; especially those of the National Antarctic Expedition, and I am therefore glad of the opportunity the President has now afforded me of saying a few words in connection with this subject.

When it was decided to send out the *Discovery*, working on the lines of my paper, and reducing the curves of equal magnetic inclination to one common base, which I took to be a line parallel with the Earth's geographical axis, and generalizing from the distribution of the Earth's magnetic intensity, as indicated by the lines laid down in the magnetic charts, I ventured to predict where, to be consistent with my conclusions, the greatest mass of land would be found in the Antarctic Regions. The results I indicated on a chart, which, after it had been shown to Sir Clements Markham and several others, was locked up in a drawer until the return of the expedition. The following is a rough sketch of this chart, with the indication of the distribution of land, as it is shown on the original:—



When it is remembered that before the return of the National Antarctic Expedition, and the important journeys of its various members, especially those of

Captain Scott and Mr. Armitage across what is evidently the continental mass of Victoria Land, we had practically no knowledge of where the principal mass of land would be found, the results as shown on my chart must be considered remarkably near the truth. For my purpose it was merely a question of the *mass* of the land, not its form, and it may be, of course, that Graham Land and the land in the neighbourhood is either a long and narrow peninsula, or an archipelago; either would answer the purpose.

There is not time now, nor is this the occasion, for me to do more than refer briefly to these points; but to my mind it is clear that, notwithstanding the necessity for actually measuring the inclination of the needle from the horizon-line of the observer's position, the curves of so-called equal inclination as *thus laid down on charts*, since they are not measured from a common base, are misleading, and, when it is attempted to generalize from them, tend to confusion. When the angles are all reduced to a common base of measurement, such as a line parallel with the axis of the Earth instead of the varying horizons of different latitudes, the curves are, as I have shown, much simplified, and become what they would be expected to be, supposing the needle to be drawn out in the direction of the Earth's great centres of magnetic force. I have in a general way worked out these curves for the northern hemisphere, and have also attempted some for the southern, where, although the information is meagre, the results are consistent with those of the northern hemisphere.

There are several points in Mr. Bernacchi's paper I should like to refer to, but it is now late, and I will only just call attention to the way in which his observations support the theory that land areas are generally more highly magnetized than the water areas. This will be seen at once by a reference to the tables given in the paper.

A great deal has been said about the South Magnetic Pole, but to me the areas of 90° dip, whether in the northern or southern regions of the Earth, are secondary matters, and I believe their location depends principally upon the distribution of the land and water areas of the polar regions. In all probability, if we had the greatest mass of land in the Antarctic Regions on the opposite side of the pole to which it is now, we should have the so-called magnetic pole on that side also. This is further indicated by the declination of the needle, the direction of which is, doubtless, determined by the surrounding magnetic force or intensity.

The PRESIDENT: I think the time has now come for thanking Mr. Bernacchi for his paper. It would seem that a great responsibility was placed upon so young a man. Not only was he given charge of all the land magnetic observations, but also the aurora observations and the observations connected with the seismographic instrument and with the pendulum. We must always remember under what very great difficulties and hardships these observations were taken, especially with regard to that very unpleasant little instrument for observing atmospheric electricity. I particularly admire the way Mr. Bernacchi and his companions went to work, after a frightfully hard day's work, to take the magnetic observations while away travelling over the Great Ice Barrier. Mr. Bernacchi in the tent, and his two comrades waiting outside for a whole hour for their suppers, not obtaining any warmth whatever after being exposed to this extreme cold for the whole day; and this day after day for many days. When we consider all these points, I think we ought to thank Mr. Bernacchi very warmly and very cordially for the way in which he stuck to his work, never shirking it day after day, through summer and through spring, continuing these very difficult observations requiring extreme care. I think we ought also to thank Captain Creak for the remarks which he has made, Captain Chetwynd for the very interesting information he has given us, and Mr. Reeves for the great trouble he has taken in explaining to us his views respecting magnetism. In adjourning the meeting, I ask you to pass a vote of thanks to Mr. Bernacchi and those who have joined in the discussion.

Mr. BERNACCHI: I thank you most heartily for your vote of thanks, and for your attention this afternoon. There is one thing I should like to say: That although the observations were only too frequently difficult to carry out, the work was very greatly facilitated by the assistance and interest taken in it by other members of the expedition, especially the assistance rendered by Captain Scott on every possible occasion, and the personal assistance in taking observations by Engineer-Lieut. Skelton. There is one point I would speak about, and that is with regard to observations taken on the sea-ice close to the shore. It would be interesting to know whether the daily and monthly changes on the sea-ice away from the land masses are exactly the same as the changes observed on shore. I think possibly they are not. A dip observation taken on the sea-ice before starting on the Barrier sledge-journey, and another taken a month afterwards on our return, show practically no difference between the two sets, whilst there is a considerable difference between two sets taken on shore; that is to say, one set before the expedition set out, and another after it returned, a difference amounting to something like ten minutes of arc. It was at the time when the dip was changing rapidly—at the end of January and the beginning of February. Thus, whilst there is practically no change on the ice, there is a very large change on land. At Cape Adare, in 1898, there was practically no monthly difference or only a slight monthly difference in the inclination, whilst at Winter harbour there is an annual difference of something like forty minutes of arc. I think it is rather difficult to account for this difference in two places where the rocks are of much the same nature.

Captain CREAK: In the Arctic Expedition, when they had the instruments on ice they got a different result to what they had when they were placed on land. You may remember I made a point of asking your expedition to inquire into that question. This question of disturbances on land is the reason Americans are setting to work to survey the whole ocean on board ship. Land observations alone do not give satisfactory results, and they want the oceans to give their quota, so as to get more definite conclusions as to terrestrial magnetism.

REVIEWS.

AFRICA.

SOUTH AFRICAN RACES.

'The Native Races of South Africa.' By George W. Stow, F.G.S., F.R.G.S. Edited by George McCall Theal, LITT. D., LL.D. London: Sonnenschein. 1905. *Map and Illustrations. Price 21s. net.*

THIS is a very important work, which in some portions will probably rank as a classic in African ethnology. It was compiled by the late Mr. George Stow, who arrived in Cape Colony in 1843, and who died (apparently) in the "eighties" of the last century, leaving behind him a book which was nearly ready for publication, and which was to be dedicated to the late Sir H. Bartle Frere. The work seems to have remained for a long time in the possession of Mr. Stow's widow, and might never have seen the light had it not been purchased from that lady by Miss Lucy

C. Lloyd, a connection of the celebrated Dr. Bleek.* Miss Lloyd in 1904 handed over the late Mr. Stow's manuscript to the historian of South Africa, Mr. McCall Theal. The latter submitted the work to careful editing and pruning, only, however, cutting out of it the unnecessary mass of quotations from other writers on Africa which Mr. Stow had thought necessary to introduce into his studies as confirmation of his theories, or as obvious inaccuracies to be contradicted and shunned. As what the public really wanted was the result of Mr. Stow's direct studies of the Bushmen, Hottentots, and the Basuto section of the Bantu, the editor acted quite wisely in relieving the work of this extraneous matter, in many cases no longer of any interest, since it related to dead controversies.

I have gone into all these details concerning the origin of the book under review, to give some idea of the time at which it was compiled. Apparently, nothing was added to the book by Mr. Stow after 1880. It is necessary to lay some stress on this, because some of Mr. Stow's arguments regarding the place of origin, the route of migrations, and even the inter-relationships of the Bushman race, the Hottentots, and the many tribes of the Bantu are to a great extent disqualified by the vast amount added to our knowledge of African anthropology and ethnology since 1880. In all that relates to his own investigations in South Africa, I am convinced that Mr. Stow will rank very high as a trustworthy authority. But his deductions and theories relating to Africa north of the Zambezi are often misleading, sometimes incorrect, and very much out of date; and it is to be regretted that Dr. McCall Theal, in his editing, should not have been able to qualify such of his author's theories as were drawn from erroneous statements about Central African races made by unscientific travellers. For example, it is doubtful whether Mr. Stow at the present day would have adopted the theory that the Pygmies of the Congo Free State were related to the Bushmen, and were relics of an ancient Bushman migration from the Sudan to the west of the Albert Nyanza down through the Congo basin to South Africa. We are still very far from being in a position to speak dogmatically on the origin of the Bushmen and Hottentots. Certain stone implements found at the south end of Lake Tanganyika and in Nyasaland would seem to show that the Bushman race may have extended as far west (from the East Coast) as the region of the Central African lakes. A language which is spoken in the desert regions of German East Africa (Sandawi) suggests relationships with the Hottentot speech. Individuals amongst the Andorobo nomads in equatorial East Africa present occasionally marked physical resemblances to the Bushman, whose mode of life they also follow in many particulars. It would almost seem as though the dwarfish Bushman was a form specialized in South Africa from one of the earliest types of Negro that entered the African continent at a most remote period. A type kindred in origin may have been the ancestor of the Congo Pygmy, who, indeed, was possibly at the same time the ancestral form of the big black Negro. All the Hottentot migrations likewise seem to have been from North-East Africa, southwards through the eastern regions of the continent, away from the great Congo forest. Mr. Stow adduces a remarkable route for the Hottentot journey to South Africa: he makes them pass between Nyasa and Tanganyika, right across the southern basin of the Congo to Angola, and thence down the south-west coast.

* It should not be necessary to remind the readers of the *Geographical Journal* that Bleek was librarian at Cape Town, and was the founder of Bantu philology. He died before he could complete his masterly study of the Bantu languages. Miss Lloyd (I write under correction) is his niece, and has devoted herself for years to the study of the Bushman race. It is to be hoped that she will some day give the result of her investigations to the world, especially publishing at the time her great collection of photographs of this nearly extinct race.

The Hottentots probably arose as an early mixture between the Nilotic Negros and the Bushmen, with a preponderance of Bushman blood. Their progress into South-West Africa has been undoubtedly from the south, northwards up the coast regions, and therefore in the reverse direction to that indicated by Mr. Stow. They seem to have found some of South-West Africa (parts of Damaraland) already inhabited by a tall but prognathous type of West Coast Negro, who was possibly a predecessor of the Bantu.

Mr. Stow makes a great difference between the "Painting" Bushmen and the Bushmen given to sculpture or engraving. According to him, one section of this race invariably makes its representations of men and animals on rock surfaces by painting with various coloured earths, while the other section of the race as invariably employs the art of engraving or sculpture. Miss Lloyd is quoted (and I think rightly) as deprecating the extreme importance attached by Mr. Stow to this classification.

This much may be said in criticism, but in other respects one's praise of the book may be almost unstinted. No such admirable picture has ever been drawn before of the Bushman's mode of life, his physical structure, beliefs, and surroundings. Herein is given a wonderful picture of the life of primitive man, possibly of such hunters as lived in our own country in the Palæolithic Age. The Bushmen were emphatically in the Stone Age when first discovered by Europeans, but they had developed a remarkable graphic art, more wonderful in its accuracy even than the drawings of the European cave man. Admirable reproductions are made, through Mr. Stow's coloured drawings, of the Bushman wall-paintings, showing ostriches, male and female (and a Bushman with an ostrich disguise approaching the birds), of gnus, hippopotami, pythons, elands, lions, and the human hunter.

The Bushmen, apparently, had only distinctive numerals for one, two, and three. Four was expressed by repeating the word for two, five by adding the word for one to twice two, and so on up to ten, which was the word for two (*t'oa*) five times repeated. The word for three, *'kwo*, apparently meant not only three, but numbers in general beyond the duplicate, so that the numeral two was the basis of their computation.

They were very fond of music, and on p. 108 is a plate showing the development of stringed instruments from the Bushman bow. One of these developments, the tying down of the bow-string in the middle, is met with amongst the Congo pygmies.

Bushman children were not named after their father or any other relation, but usually from the place, circumstances, or surroundings in which they were born.

Mr. Stow writes most sympathetically of the Bushmen, and of the happy life they led before the cruel European and his equally cruel ally, the Kaffir, came on the scene. They lived in a land teeming with wild beasts to an unprecedented extent (so far as we know of the history of the Earth). They even declared in their traditions that there were still more wonderful wild beasts living in South Africa in the days of their far-back ancestors, that have since become totally extinct. They seldom, therefore, went hungry for want of meat, and the country supplied a sufficiency of roots, fruits, and fungi for the element of vegetable diet. They had many dances, to which they were devotedly attached. Mr. Stow gives a touching description on p. 103 of an old Bushman husband and wife being reminded of the happy days of their youth.

"This interesting old couple expressed their delight continually, as with twinkling eyes they were shown the different copies of their cave-paintings, explaining all they saw, and emphatically terming them '*their* paintings,' '*their own* paintings,' 'the paintings of their nation.' Coming at length to the copies of some dances, old 'Kou'ke immediately exclaimed, 'That, that is a grand dance. It is the 'Ko-'ku-curra!' This, she said, had gone out of fashion when she was a little girl, but used always to be danced in the days of her grandmother's grandmother. 'I know it! I know the song!' And at once, moving her head and body to the time, commenced the following: . . . [Here are given words and tune.]

"Whilst 'Koukie was singing the upper line the old man became visibly affected, and kept continually touching her arm, saying, 'Don't! don't!' She, however, continued, when he again said, almost pitifully, 'Don't! Don't sing those old songs; I can't bear it! It makes my heart too sad!' She still persisted, with more animation than before, evidently warming with the recollection of the past, until at length the old man, no longer able to resist the impulse, broke into the refrain shown in the second line. They looked at each other and were happy, the glance of the wife seeming to say, 'Ah! I thought you could not withstand that!' One was not prepared to meet with such a display of genuine feeling as this among people who have been looked upon and treated as such untamably vicious animals as this doomed race are said to be. It was a proof that 'all the world's akin,' and was certainly a Bushman edition of 'John Anderson—My Jo, John.'"

The chief interest—I may say the remarkable fascination—of this book will, in the eyes of most readers, be that large proportion of it which deals with the Bushmen and their former life. But there is a great deal of valuable material about the Hottentots and the Hottentot hybrids, about the Damaras, and, above all, the great Bechuana or Basuto section of the Bantu peoples. It is interesting to notice, by-the-bye, that the silly and meaningless mis-spelling "Bechuana," which has become so well established now as the name for the first of the three great divisions of the Bantu south of the Zambezi, is ignored by the author, who writes the word Bachoana. There is reason to suppose that the Sechuana-speaking Bantu were the first representatives of that great African section of the negro race to enter South Africa. Their physical appearance in many tribes suggests considerable intermixture with Hottentots or Bushmen in earlier days. The language they speak is rather a degraded and worn-down type of Bantu speech, but it exhibits little or no sign of having borrowed from the Hottentots either in vocabulary or pronunciation—unlike, apparently, in this respect the Zulu-Kaffir. At its roots the Sechuana is more connected with the Kaffir group than any other division of the Bantu family. But it has acquired a remarkable phonetic development of its own, offering resemblances, perhaps only superficially, to the Makua languages of South-East Africa north of the Zambezi delta.

Mr. Stow gives a most interesting account of that strange event in the dawn of South African history—the invasion from across the Limpopo of the Mantati cannibals. This was one of the extraordinary movements characteristic of universal history until a real civilization had fixed rigid bounds to the movements of peoples. A whole nation of naked Bantu cannibals came down on South Africa from the north-east. Whether they spoke a language akin to the Zulu or to the Makaranga divisions about the Zambezi, or whether they were a race travelling from the heart of Central Africa, does not seem to have been known at that date or subsequently; but from out of the vast unknown that lay beyond the Bechuana steppes came a whisper, a rumour, that there was sweeping down on these lands, where the Bechuana were more or less happily settled, an awful horde of cannibals, who spared neither man, woman, nor child. The first missionaries had come into the Bechuana country from the south, and they, with their advice and active assistance, enabled the Bechuana to make a stand against the Mantati, who, after one or two disastrous defeats, melted away, back into the unknown regions from which they had come. Their attacks on the Bechuana nation were succeeded by those of the Matabele section of the Zulu race. But Mr. Stow had not concluded his work evidently at the time of his death, for although he treats with such fulness of the Sechuana-speaking people and of the Damara and Ovampo, he says nothing of Zulu-Kaffir stock or of the (to him unknown) Makaranga people south of the Zambezi, who perhaps constitute the third Bantu element in Southern Africa.

But the book is one to which it is impossible to do full justice in a review. Would that there were more Stows in the African world to produce such splendid studies of vanishing and altering peoples!

H. H. JOHNSTON.

POLAR REGIONS.

THE ANTARCTIC.

The Story of Exploration, edited by Dr. J. Scott Keltie: 'The Siege of the South Pole.' 70 *Illustrations and large Coloured Map.* By H. R. Mill, LL.D., D.SC. London: Alston Rivers. 1905.

Dr. Mill's history of southern voyages is a much-needed and very welcome book. The Arctics had Sir John Barrow's two volumes of chronological history, and Mr. Shillinglaw's work came out just before we sailed. But they were dull reading, incomplete, and often inaccurate. We preferred the original texts. Thus warned, we supplied our Antarctic Expedition with the published works of Ross and Weddell; we printed Captain Davis's charming letter to his sister, and embodied the texts of Biscoe, Balleny, Dumont D'Urville, and Wilkes in the 'Antarctic Manual.' Actual students of the subject will turn to these fountain-heads; yet they will also have to use Dr. Mill's book for information which cannot be found so easily elsewhere. His chapter on the American sealers, a very obscure subject, is valuable and interesting. Dr. Mill has here brought together much information which would be vainly sought for, in so compact a form, elsewhere. He appears to be indebted, to some extent, to Mr. Balch. It is a pity, however, that so much space should be wasted on Captain Morrell. Dr. Mill has done a still greater service in his chapter on the voyage of Bellingshausen. Until quite lately the work of this eminent explorer was only accessible in the Russian language, although we have long had the use of his maps. The first coral island ever seen by the present writer was named after Lazareff, the second in command of Bellingshausen's expedition; so that we have had the maps showing the track for many years, but not the narrative. At length, in 1902, an abstract was published at Leipzig. It is nearly a complete German translation. We owe to Dr. Mill the first full account of Bellingshausen's voyage in English, and, as the complement of Captain Cook's Antarctic voyage, it is both important and interesting.

Dr. Mill's record of all the other voyages is complete, and well arranged; while the author deserves great praise for a diligent and painstaking accuracy in every detail, which enhances the value of the work, and gives confidence in using it. Thus the Antarctic student is furnished, not only with a reliable book of reference, but also with valuable information which he could not well find elsewhere.

But we hope that the book will serve a still more valuable object. It is written in a most agreeable style, and some parts of the story are quite fascinating. It is most desirable that it should be widely read, and the literary ability of the author gives every promise that it will be popular. W sincerely trust that this will be the case, and that the reading public will thus become so well acquainted with the work that has been achieved, that it will take an intelligent interest in what remains to be done.

Dr. Mill's book will show how much remains. One who rises from its perusal must do so with a feeling of surprise at the title—'Siege of the South Pole.' With the exception of the expeditions of Sir James Ross and Captain Scott, there has not only been no siege of the south pole, but barely an attempt to go south at all within the Antarctic Regions. There have been various reconnaissances of the Antarctic Circle, usually at a respectful distance to the north. Some of the voyages described by Dr. Mill have never reached the Antarctic Regions at all; others have just crossed the circle.

It is like calling a cruise to Hammerfest a siege of the north pole. Weddell and Bruce have been furthest, making summer cruises in the Weddell sea, and Bruce has furnished us with a valuable series of soundings. But the real work begins where they left off. We regret to see that Dr. Mill is in favour of consultative committees, stations far north of the Antarctic Circle, and another cruise round the threshold. Surely he cannot continue to call this a 'Siege of the South Pole'! It is to be hoped that there will be no more committees, and no more pottering round the Antarctic Circle. Future voyagers must cross it, if they call their voyages Antarctic, as the very beginning of their work. There are several routes for resolute men who know their business. The next will be down the east coast of Graham's Land. But the course is SOUTH.

In conclusion, we congratulate Dr. Mill on the production of a book which will be of lasting value, and which is calculated to do lasting good to a great cause.

C. R. M.

'Two Years in the Antarctic.' By Albert B. Armitage, Lieut. R.N.R. London: Edward Arnold. 1905.

This unpretending narrative of the National Antarctic Expedition by Lieut. Armitage follows the larger and more complete work of his chief, with whose generous consent the present volume appears. Lieut. Armitage is an officer of great merit. He was mentioned to us by the chairman of the company he serves, as an officer who would prove useful in many ways. This indeed was the case. Armitage had experience in the navigation of polar ice, in Arctic sledge-travelling, and in taking scientific observations. He is a practical navigator, a judicious manager of men, and a good messmate. He proved himself to be staunchly loyal.

Immediately on his appointment, he entered into the spirit of the work most zealously, and sent in an exhaustive list of sledge equipment and clothing, with valuable notes. Captain Scott used his services to proceed to Norway and procure all the gear for sledging, and see that everything was properly made and fitted. Besides his work as navigator, Armitage had charge of the magnetic observations at sea.

The reader will expect an interesting narrative from such a man, and he will not be disappointed. Throughout we see that Armitage liked and appreciated his work, liked his companions, and was liked by them. He was one of a very happy company. Often humorous, never dull, the story as told by our polar veteran ought to find many interested readers.

C. R. M.

THE MONTHLY RECORD.

EUROPE.

German Sea Fisheries.—A comprehensive account of German sea-fishing is given in a recent Consular Report (Misc. Series, No. 636). The gross tonnage of the German fishing fleet in 1904 was 47,860, a marked increase on previous returns: 451 were sailing and 172 steam vessels. The gross tonnage registered at Geestemünde alone was 8664, and the net tonnage entering the port in 1904 was 106,699. The total result in wet fish, sold by auction in open market, for German deep sea and coast fishing was £966,021, of which £262,151 fell to Geestemünde's share. One steamer of that port made forty trips in 1903, and one vessel loaded 50 tons. The comparatively new Dutch fishing port of Ymuiden seems, however, to seriously threaten the position of this and other German North sea ports, being, as it is, nearer to a large part of north-west Germany, especially the Rhine province. Geestemünde, however, maintains its hold on the Iceland fishery, over 20 per cent. (by value) of the fish landed coming from that region. Of the fish imported into Germany over 40 per cent. is British-caught, so that the recent increase in the consumption per head is of great importance to the British industry. In 1903–4 the total number of salmon taken on the lower Elbe and other estuaries was 2152 against 3256 in 1902–3; 1000 young salmon were set out on the South Elbe in 1903–4. An Altona vessel returned from Siberia in December, 1903, with 60,000 frozen and 80,000 salted salmon. The catch of herrings and sprats showed a diminution in the year under review, but herring spawning-places have lately been found in Kaiser Wilhelm canal, and in its waters herrings are steadily becoming more plentiful. The German fleets engaged in herring fishing in 1903–4 included 138 smacks, 10 steam-drifters, 8 steam-smacks, and 1 motor smack. Over a million oysters were taken on the North sea coast, and the feasibility of cultivating oysters on a large scale on its mud-flats and estuaries is being considered. Besides its police duties, a special cruiser service gathers information regarding the movements of fish shoals, sizes of catches, loss of nets, and telegraphs details to the Fishery Association, which then conveys the information to the fishing companies. In 1904 the cruiser *Zieten* made a voyage to Iceland reporting results to the association. A shelter was then in course of erection at Reykjavik, and the *Zieten's* commander called for a second shelter to the westward and another on Myrdal's sand, as also for the erection of two beacons. Government assistance includes building subventions of £200–£250 to herring smacks, sums for purchase of nets and gear, and loans to fishermen. Other encouragements are harbour works; a fishery museum at Altona, now to be enlarged; barometers for fishermen at 2*s.* 6*d.* each; rewards for marked plaice; and public lectures. Government encouragement, it is believed, takes account of the prospective value of the material available for the manning of the navy.

ASIA.

Austrian Explorations in Asia Minor.—An expedition to the Erjias Dagh, the highest summit of Asia Minor, primarily for the purpose of botanical and zoological research, was sent out in 1902 by the "Gesellschaft zur Förderung der naturhistorischen Erforschung des Orients in Wien," under the leadership of Drs. A. Penther and E. Zederbauer, the former of whom has given an account of the work accomplished in the *Abhandlungen* of the Vienna Geographical Society (1905, No. 1). The travellers made a very thorough examination of the mountain group from their special point of view, pitching their tent at a number of different points, sometimes at considerable elevations, from which they made ascents of many of the summits, besides other excursions. Dr. Penther's principal attention was of necessity given to zoology, but he devoted some time also to the taking of bearings and photographic surveys, the resulting map, which has been worked up by Herr Tschamler, of the Military Geographical Institute, being thus a useful contribution to an improved knowledge of the Erjias Dagh. Dr. Penther, although not a pro-fessed geographer, has evidently an eye for the physical characteristics of a district, and his descriptions of the nature of the mountains are of much interest. As well known, the group is volcanic in origin, and some of the peaks (such as, *e.g.*, the Lifos, towards the north,' the first to be ascended), bear evidence to their mode of origin in their regular conical shape, though their craters have been entirely shattered. Others of the summits (such as the Kartyn, not far from the Lifos) are nothing but gigantic piles of rocks. Dr. Penther expresses a doubt as to the volcanic character of all the subsidiary peaks, some being possibly the result of glacial erosion. An interesting feature in the group are the jailas, or summer stations of herdsmen, which are found at considerable altitudes on the mountain-sides, and seem to closely resemble those of the Alps and other ranges. They mostly consist of tents of leather or other material; but in one, that of Kyzyk, on the slopes of Karasivri, the shelters were of the nature of holes excavated in the hillside. The mountain group is divided into two by a north-to-south depression (followed by the main route from Kaisarieh southward), the smaller section to the east consisting of the Koch Dagh and associated summits. This is perhaps to be regarded as the remains of an ancient crater-wall, of which the western side has fallen in, and seems, in any case, to be older than the main summit of the Erjias Dagh, and many of the parasitical cones may possibly belong rather to this old volcano than to the newer one. Glaciation seems to have been most developed towards the north-west and south-west, in the former of which directions there still exists a secondary glacier, which is perhaps to be taken as the scanty remnant of a former greater extension of ice, though the absence of striations, *roches moutonnés*, etc., would tell against this idea. Dr. Penther throws doubt on the statements of Tchihatchef and Hamilton as to the existence of several glaciers, especially on the south side, saying that, as there seems to have been a greater amount of snow at the time of their visits, any true glaciers must have been hidden by the snow-covering. He is inclined to think that what they saw were snow or *névé*-fields, though he allows that, in the recent general retreat of glaciers, such may have disappeared in the intervening time.

Geological Results of the Tibet Mission.—As was mentioned by Sir Frank Younghusband in his paper read before the Society, the Tibet Mission was accompanied by Mr. Hayden, of the Geological Survey of India, whose observations have for the first time supplied accurate data respecting the geological structure of central and southern Tibet. A preliminary note, giving in outline the results of the observations, has appeared in the *Records of the Geological Survey of India* (vol. 32, part 2, 1905). The most striking feature in the geology of the region traversed is the wide extent of the Jurassic formations, which cover almost the whole area between the Himalayas and Lhasa, extending also far to the north into the hill ranges separating the Pembu valley from the basin of Tengri-nor. They have, however, yielded but little of interest, for the whole area has suffered so severely from metamorphism that the rocks consist chiefly of crushed and altered slate and limestone, with quartzite and calc-schist. Some highly fossiliferous limestones of Middle Jurassic age were, however, found to the south of Khamba Jong. In Sikkim and the Chumbi valley the prevailing rocks are gneiss and granite, the boundary between these and the younger sedimentary beds to the north following the line of the highest peaks (Pauhanri, Kangchenjhau, Chomiomo, etc.), all of which are crystalline, while a line along their northern slopes marks the beginning of the sedimentaries. Some schists and crystalline limestones, found at Talung in the Khongbu valley, may be of Palæozoic age, while a part of the Triassic system seems represented further east. In Tibet a belt of Cretaceous and Tertiary rocks runs from Khamba Jong a little south of east to Tuna. Abundant evidence of a former greater extent of glacial conditions in the Trans-Himalayan region was met with in the form of old moraines, erratics, old lake-basins, and the like. Throughout the plain of the Yaru river, around Khamba Jong, characteristic *roches moutonnés* show the direction of flow of old glaciers from the northern slopes of the Himalayas; while erratics supply evidence that the drainage from the neighbourhood of Kangchenghau must once have had a northerly trend, and that consequently the Lachen and other streams have widely encroached on the original northern system. Of the lakes, both Kala-tso and Yamdok-tso apparently owe their existence to the damming up of old river valleys by fans from side valleys, and the consequent formation of an area of closed drainage. Old terraces, at some height above the present levels, show that both lakes have shrunk since their formation. The area visited is strikingly poor in minerals of economic value, though gold occurs in very small quantities in the Sanpo gravel.

Mountaineering in the Himalayas.—Dr. Jacot-Guillarmod, of Neuchâtel, one of the members of the expedition which effected some ascents in the Karakoram Himalayas two years ago, has lately proceeded to the Sikkim part of the range, accompanied by several companions (Swiss and English), in the hopes of achieving the ascent of Kangchenjunga. The expedition has already met with a disaster, one of its members, Lieut. Pache of Neuchâtel, having been killed by an avalanche while crossing a field of *névé*. Three natives are said to have also been killed, while two of the other Europeans were only slightly hurt. It is said that the party will renew the attempt next year.

Obrucheff's Recent Journey in Central Asia.—The eighth number of the *Zeitschrift* of the Berlin Geographical Society contains a communication from the well-known traveller, V. Obrucheff, on a journey undertaken by him last summer in Dzungaria, the Tarbagatai, and neighbouring ranges. Geologically, the said ranges are said to be evidently "Horsts," while the Dzungarian Gate and almost all the valleys of the region are rift-valleys ("Graben"). On the southern side of the Saur clear traces of the former existence of glaciers were seen. The traveller made interesting observations on the distribution of the loess, on denudation in the desert, and other subjects.

Dr. Tafel's Geological Researches in China.—Lieut. Filchner, whose interesting journey across the highlands of North-Western China was described in the May number of the *Journal* (p. 562), was accompanied, as will be remembered, by a geologist, Dr. Tafel, whose observations shed much new light on the structure of the region traversed. Dr. Tafel has since carried out other journeys in Northern China, mainly in the region of the middle course of the Hwang-ho, and has communicated some of the results of his observations to the Berlin Geographical Society (*Zeitschrift*, No. 8, 1905). We hope to recur to his conclusions respecting the geological history of the region in a subsequent number.

History of Korea's Relations with China.—The question of the precise relations in which Korea has stood with China within the last four or five centuries has always been more or less of a puzzle, owing to the apparent difficulty of reconciling the claim of China that Korea was a subordinate country, with the admission (made by the Chinese Foreign Office in 1871) that the smaller country was "wholly independent in everything relating to her government, her religion, her prohibitions, and her laws." Mr. Rockhill has sought to throw light on the question in a brochure entitled 'China's Intercourse with Korea from the Fifteenth Century to 1895' (London: Luzac, 1905), in which, by the aid of a further study of Chinese authorities, ancient and modern, he extends and modifies the substance of a paper originally printed in 1888. As regards the political status of Korea, Mr. Rockhill points out the mistake which has arisen from translating the term "Shu kuo," used alike by Chinese and Koreans in official documents, as "vassal kingdom." The character "shu" carries with it the idea of relationship, which the writer holds to be the keynote to the whole question. The custom of the Korean kings to submit to the emperor of China for approval the names of the heirs to the throne, or of their consorts, is held to imply merely ceremonial relations, with no idea of subordination other than that of respect and deference on the part of the younger member of a family to its recognized head. Again, the investiture by China of the kings of Siam, Burma, Annam, Korea, etc., amounted to nothing more than the recognition of a weak sovereign by the most powerful state in Asia. Mr. Rockhill sketches the principal events in the intercourse between China and Korea during the centuries under review, and concludes with a brief account of some of the laws and customs of the latter country.

Connection between the Triangulations of Western and Southern Sumatra.—The geodetic work which has long been in progress in the Dutch East Indies has lately made an important advance through the connection of the surveys in Western Sumatra with those in the south of the island and in Java. The operations and their results are described in some detail by Dr. J. J. A. Muller in the *Tijdschrift* of the Netherlands Geographical Society (1905, No. 4). The length of the side of the triangle forming the connecting link between the two surveys showed a difference of 74 centimetres, or 1 : 23,000 of the total, as determined from the two directions. This may be accounted for partly by the less degree of precision in the measurement of the base for the west coast triangulation, and partly also by the accumulated error over a total distance of 600 miles. The latitude of Gunong Talang, as determined by the west coast triangulation, was 2° 6′ 8″·699 S., and by the southern triangulation, 2° 6′ 9″·312, and this difference of 0″·6 is reduced to 0″·2 if the sides of the west coast triangles are increased throughout in the above proportion of 1 : 23,000. The longitude of the point designated "Basis-West" at Padang comes out, in whole seconds, as 6° 26′ 26″ west of Batavia, as determined by the geodetic operations.

AFRICA.

French Exploration in the Sahara.—It will be remembered that a junction between the Algerian Sahara and the Niger was last year effected by parties which started from either side, and met at an intermediate point not far from the Adrar *massif* (*Journal*, vol. 24, pp. 348, 481). This year the whole distance between Algeria and the Niger has been traversed by one traveller, M. E. F. Gautier, whose excellent studies on the physical geography of the north Saharan borderlands have been frequently alluded to in the *Journal*. After first carrying out scientific explorations in the Tuat region (*Journal*, July number, p. 86), M. Gautier, with M. Chudeau, a geologist, joined an expedition under M. Etiennot, which was to examine the route for a telegraph line accross the Sahara. The explorers set out from Tuat on May 12, 1905, and two months later M. Etiennot returned northwards, while M. Gautier pursued his way without any native escort, accompanied for several days by one servant and one guide only. Gao, on the Niger, was reached on August 3. A short account of the journey, based on a communication to the *Le Temps*, appeared in the October number of *La Géographie*. For the last 375 miles before reaching the Niger, the traveller crossed an unbroken steppe, covered with a widely spaced forest of mimosas, between which a fine grass grows. This M. Gautier considers as characteristic of the southern border of the desert from the Atlantic to Egypt. Taodeni, the site of the well-known salt-deposits, seems to be the centre of a vast depression, on which all the wadis from the Moroccan Atlas and the Hoggar *massif* converge. According to native accounts, it still boasts an abundance of water, and must in very ancient times have been occupied by a great lake, in which the Niger terminated. Like some other writers, M. Gautier believes that in neolithic times the Sahara was comparatively well watered, and supported a considerable population. As proofs, he points to the rock-drawings, tombs, and, above all, the hand-mills which are met with everywhere from Algeria to the Niger. M. Gautier found the Silurian formation—highly metamorphosed and comparable to the Caledonian of Northern Europe—the dominant one in the region traversed. This is of much importance, as, although this formation had been reported by Foureau and other travellers, we were hitherto quite ignorant of its extension. The same number of *La Géographie* contains the narrative of M. Villatte's journey to Adrar last year, to which we hope to recur in a future number. It is accompanied by a large-scale map, based on the traveller's surveys.

Reconnaissance in the Western Sahara.—Another journey of some interest has been lately made by Captain Flye Sainte-Marie, in the little-known region west of Tuat. An account of the journey has appeared in the *Renseignements Coloniaux*, published by the Comité de l'Afrique française (1905, No. 10 bis). The wide region of sandhills west of the Saura, known as Igidi, has been much harassed of late by marauding bands from the southern borderlands of Morocco, and little has yet been done by the military force stationed in Tuat to extend its activity in this direction. The recent expedition, for which careful preparations had been made for some time, was of the nature of a reconnaissance intended to pave the way for future operations. Its object was, by striking west across the principal north-to-south routes of this part of the Sahara, to study the present political and economic position of the region. The reconnaissance proved very successful, a point being reached in about 6° 50′ W., only about 112 miles from the site of the former important trade-centre of Tinduf. All the main routes from Southern Morocco to the Sudan *viâ* Taodeni were intersected, as well as minor deviations of secondary importance. The main routes are six in number, three starting from Tafilet, two from the Dra (one of them followed by Caillié), and one from Tinduf (that of Lenz). Of these, five depend for their existence on three important districts in the Igidi or on its borders, all lying within a zone of only 170 miles in width, and the command of these points would virtually control the whole of the communications of this part of the Sahara. The positions of two of the districts (which, like the Igidi in general in a less degree, are rich in pasturage) correspond with a marked change in direction in the direction of the dunes, which seems not entirely accidental, though the reason requires further investigation. During the whole journey the party never came in touch with the raiding parties, which seem to have acquired a wholesome respect for the French. As regards the trade of this region, it seems at present to have almost disappeared, for not a human being was encountered during an itinerary of some 1200 miles, while two raiding parties and three small caravans represent the sum total of the operations of a whole year. The reason suggested is the presence of the French at Tuat, which has placed a check on the traffic in slaves, while with the decrease of commerce raiding has increased, a result being the entire desertion of Tinduf since 1903. Captain Sainte-Marie thinks, however, that with the pacification of the district a certain amount of the former trade may spring up again. The report is accompanied with a sketch-map, but a detailed map of the results of the journey is promised for the next number of the periodical.

Agricultural Resources of East Africa Protectorate.—A Report by Messrs. J. C. Bailie, T. C. Hinds, and F. R. N. Findlay gives a running view of the salient features of the East Africa Protectorate within the railway zone, nearly 600 miles long by 50 broad, from Mombasa to Fort Florence, by about 50 miles broad.

Embodying the observations of three practical South African colonists during a three months' journey in the highlands of the protectorate, the booklet should be specially serviceable to intending settlers. The report gives on the whole a very favourable impression of the land, and inspires hopeful expectations of its future. Only a few items may be quoted. About Simba, 3350 feet high, was found a really good stock country, with good soil, the great drawback there and thence to mile 260 being scarcity of water, aggravated by the porous nature of the soil. To the south, low conical hills, recalling features of South Africa, extend towards Mount Kilimanjaro, 80 miles distant, and occasionally visible from the railway. Abounding in game, the land around Simba is a favourite resort of the lion, which will sometimes come within sight, and has been known to take possession of the station. At Kiu 20,000 acres of grazing-land have been taken up. Nearly two pages are given to an account of the thriving town of Nairobi, which already boasts many buildings erected or in course of erection, surrounded with gardens, and commanding wide views. In Nairobi living is cheap. Two rupees (2*s.* 8*d.*) buy 7 lbs. of bread and 5 lbs. of meat, or 120 lbs. of potatoes. Wakikuyu labourers cost 4 to 6 Rs. a month, without food. The best stock country, however, is the Rift valley. Extending from north end of Lake Naivasha to the southern slopes of Menengai hill is splendid sheep-pasture, and the greater part of the best grazing-land has been applied for. The projected Zionist settlement is estimated as a promising stock and agricultural land. The Nandi plateau shows extensive native agriculture. The whole of the highlands is "perfectly healthy," as witnessed by the ruddy-cheeked children, and parts compare favourably with the best cattle and sheep districts of South Africa; but as a whole the highlands cannot be said to be well watered. The writers' assurance of the future prosperity of the country and its suitability for immigrants prepared to make it their home and possessed with a capital of at least £1000, is endorsed in a note at the end by Lord Hindlip.

Major Powell-Cotton's Expedition.—News has been received in this country of the safe arrival of Major Powell-Cotton (*Journal*, vol. 24, p. 677) in the region of the Equatorial forest about the sources of the Aruwimi.

Ethnological Investigations in the Southern Congo Basin.—The well-known German ethnologist, Dr. L. Frobenius, has undertaken an expedition to the region of the Kasai for the study of the native tribes of that part of Africa. The traveller left Antwerp on December 29, 1904, and made his way into the interior by the Congo route to the basin of the Kwilu. A letter describing the observations made down to May 24 last is printed in the 6th number of the *Zeitschrift* of the Berlin Geographical Society. This is, we believe, the first time that the somewhat perplexing tribe-relations of this region have been studied on the spot by a professed ethnologist, and valuable results may be expected from the journey.

Scientific Research in the German African Protectorates.—We learn from the *Zeitschrift* of the Berlin Geographical Society (1905, No. 7), that a scheme has been drawn up for the systematic investigation of the geography of the German African territories. Hitherto, it is felt, much has been lost by the dissipation of energy among various channels, and it is hoped that more valuable results will be gained by the concentration of effort under one organization. The scheme is the result of the deliberations of a committee appointed last year for the purpose, and it is proposed to carry out the objects in view by stationing scientific observers at Government stations, attaching them to expeditions, and similar methods. The scope of their researches will embrace "all branches of scientific knowledge which have to do with the Earth's surface, its vegetable, animal, and human inhabitants."

AMERICA.

Raised Shore-lines in Southern Ontario.—The summary Report of the Geological Survey of Canada for 1904 (Ottawa, 1905) contains a note by Mr. A. F. Hunter on an examination of the ancient high-level shore-lines which are to be seen along the flanks of the Blue mountain escarpment, south of the Georgian bay of Lake Huron. This escarpment runs in a generally north-west by north direction from the head of the Nottawasaga valley up into the Bruce peninsula. In spite of its apparent straightness, it is really formed by a series of niches cut into the edge of the Niagara limestone and underlying formations which form the table-land of south-western Ontario; the niches marking the position of parallel transverse valleys divided by ridges with the prevailing north-east by north direction of this part of Canada. Throughout the valleys there are well-developed terraces, which show that the valleys are not the result of erosion in recent geological times. The terraces pass from the lake-shore into the transverse valleys without change in character, so that the latter were evidently bays during the period of submergence. There are a few broad terraces more conspicuous than the rest, each representing a period of strong activity, or else a stationary condition of the water-surface. The lowest is the Algonquin shore-line, forming the base of the rising ground. Its altitude varies roughly between 740 and 790 feet, the cause of the variation being probably a local deformation, as one of the best-marked higher terraces is nearly horizontal. The second shore-line is about 180 feet, and the third about 300 feet, higher than the first, both again showing traces of deformation. The most striking of all the terraces is, however, the high-level one already referred to, which runs at a level of 1430 feet above the sea, and has a considerable range throughout the district. It has in places the great width of a mile or more, and is throughout associated with high rocky cliffs of Niagara limestone, at whose base the old water-line is seen. It is, in fact, almost entirely owing to the action of the water when at this level that there are so many good exposures of the Niagara formation. While occupying a considerable width elsewhere, the terraces all converge to within the space of half a mile at Craigleith.

Surface Features in Montana and Idaho.—One of the most rugged and forbidding sections of the Rocky mountains of the northern United States is that occupying the eastern part of the Columbia river-basin in the states of Montana and Idaho. Between the Bitterroot valley on the east and the Clearwater on the west lies a broad band of elevated country, forming in the east the well-defined range of the Bitterroot mountains (rising in Trapper peak to a height of over 1000 feet), while further west, occupying a large area in Central Idaho, the Clearwater and Salmon River mountains form a wide uplift, with peaks of about 8000 feet, falling westward to the plateaus of the lower Salmon and Snake rivers. This country was the scene of a geological reconnaissance, in the autumn of 1899, by Mr. Waldemar Lindgren, who sketches the geology and surface features in a publication of the U.S. Geological Survey (Professional Paper, No. 27, Washington, 1904). The region is of considerable interest to the student of the origin and history of existing surface features, offering as it does typical examples of some of the more striking processes of mountain-building. This is especially the case with the Bitterroot range, which, Mr. Lindgren thinks, will always remain one of the most important localities in the world for the study of the development of schistosity and distributed faults. From the well-marked depression of the Bitterroot valley the range rises westward with a remarkably even slope, which for long distances is nearly constant at angles ranging from 18° to 26°. Westward its slopes soon merge into the dissected high plateau of the Clearwater mountains.

The highest summits all occur near the eastern versant of the Bitterroot range, while the divide forming the boundary between Montana and Idaho lies further west at a lower elevation. The drainage shows some remarkable characters, the streams flowing in generally straight courses across the range, the face of which is scored with a number of deep cañons V-shaped in section, while the upper parts of the valleys are broadly U-shaped. Jointing of the rock, erosion, and glacial action contribute to an excessive roughness of topographic detail, making the range one of the most inaccessible. Practically the entire area of the Bitterroot and Clearwater systems is occupied by granite, with some gneiss, though sedimentary formations occupy small areas to the west, being partly exposed below the great sheet of Columbia river lava. The eastern versant of the Bitterroot range consists of gneiss, which has been derived by compressive or shearing stress from the normal massive granite forming the mass of the range. The remarkably even slope to the Bitterroot valley conforms to the dip of the gneiss, and there seems no doubt that a uniform dislocation of great extent has taken place all along this eastern face. It was accompanied partly by direct movement on minute and numberless fault-planes (slipping-planes), partly by molecular movements long enough sustained to produce a typical schistose structure. The fault seems to have been a normal one, the downthrow being on the side of the Bitterroot valley, and there are some indications that the downward movement has not even yet entirely ceased. The report is well illustrated by maps, sketches, and photographs of typical features.

AUSTRALASIA AND PACIFIC ISLANDS.

New Memorial to the Founder of Adelaide.—A reprint from the *Register and Observer* of Adelaide, South Australia, relates the unveiling of a new memorial to Colonel Light to replace the ruined old one. The ceremony was performed on June 21 last amid a great concourse of people, including over one hundred pioneers whose records began before or in 1845, among them a few who attended Colonel Light's funeral on October 10, 1839. The new monument stands 35 feet high—a conspicuous ornament in Light Square. It is of South Australian granite; the pedestal, of Monarto grey granite; and, from base of column to top, of Murray Bridge red granite. The shaft, beautifully polished, is crowned by a burnished capstan-shaped block, and upon it rests the bronze tripod and theodolite, suspended horizontally. Describing Colonel Light as the "most picturesque and fascinating figure amongst the early settlers" and "the preserver and even saviour of South Australia," the Lieut.-Governor enlarged on the felicity of the site Colonel Light had chosen for the South Australian capital, in the midst of one of the finest plains in the world, and under the shelter of hills, which both moderated the climate and secured a copious water-supply. Not less admirable was the plan of the city devised by Colonel Light, with its broad streets and park lands over 2300 acres in extent. In its port, 8 miles distant, rode ships of 8000 tons burden. The date of Colonel Light's birth seems now definitely settled. Mr. A. Francis Steuart, a great grandnephew of Colonel Light, supplied the memorial committee with a letter from Colonel Light's father, dated August 23, 1792, in which he says his son William "is now six years of age." He was therefore born in 1786, and, dying in 1839, must have been, not fifty-one, as stated on the old monument, but fifty-three years of age, as inscribed on the new memorial.

Dutch Exploration in Western New Guinea.—We alluded some time ago to the expedition organized by the Netherlands Geographical Society for the exploration of the great mountain range of Western New Guinea, and placed under the command of Mr. Posthumus Meyjes (*Journal*, vol. 25, p. 97). The original idea of penetrating to the great snowy range overland has since had to be abandoned, but some good work has been done in the way of exploring the Digul river, the principal stream of this part of New Guinea, by means of a steamer and boats. A brief account of the ascent of the Digul appears in the *Tijdschrift* of the Netherlands Geographical Society for September last (Vol. 22, No. 5). The Digul river enters the sea opposite the north end of Frederik Hendrik island, and was reached by the expedition in the *Valk* after the passage of the narrow strait separating that island from New Guinea had been effected. The *Valk* entered the river proper (which had been first examined by the steam-pinnace) on March 27, 1905. The water was somewhat low, and many more rocks were visible in its channel than were shown in De Jong's sketch-map. The Digul, which remained tidal until March 30, had all the appearance of a great river, measuring sometimes over 1700 yards in width, with a depth of 8 to 11 fathoms, and forming islands at intervals. The course was very winding, and generally from the east, while several large tributaries were seen. The banks were sometimes as high as 20 feet, and consisted of red clay, while the mud of the bottom was sometimes gold-coloured. One or two native settlements, built on piles 25 feet high, were passed during the first few days, but higher up the banks became uninhabited, though signs of habitation inland were occasionally seen. On the 31st it was resolved, from motives of prudence, not to proceed further with the *Valk*, though up to April 8 the river remained to all appearance quite navigable for ocean-going ships. From the 2nd to the 9th of that month the ascent was continued in the steam-pinnace and three other boats, a compass survey of the river's course being kept up. It had for some time assumed a direction nearly due north and south, and therefore rises in the main range of the island, but the weather was not sufficiently clear to allow of this being seen. On the 10th and 11th the water rose considerably, and as the current had now become very powerful, and the weather threatening, the explorers came reluctantly to the decision to turn back, the return voyage being accomplished in only a fraction of the time taken on the ascent. The last camp (beyond which the boats advanced a few miles only) was estimated to lie in about 5° 54′ S., 140° 6′ E., or almost in the centre of the breadth of the island; and the river was hereabouts some 75 yards wide, with a depth of 10 feet and more. At its most easterly point it seems to approach very closely to the upper course of the Fly, as shown on the maps, but there seems reason to believe that these may be erroneous.

Volcanic Eruption in Samoa.—A short account by Dr. F. Linke of the renewal of volcanic activity in the island of Savaii early in August is given in *Globus* for November 2. The outbreak, of which warning was given by the seismological instruments at the observatory in Apia towards the close of July, resulted in the formation of a new crater, a hill some 250 to 350 feet high with three vents, about 8 miles from the coast directly south of Matautu. The first eruption seems to have taken place as early as August 2, but when Dr. Linke visited the spot on August 18–19, the rocks were still glowing. A continuous sea of rock-*débris* extended for 2 or 3 miles north of the centre of eruption, but no lava-stream was visible.

POLAR REGIONS.

Captain Amundsen's Expedition to the North Magnetic Pole.—Letters from the leader of this expedition have at last been received, giving an account of the work accomplished down to May 22nd of the present year. They were despatched from Captain Amundsen's headquarters in King William's Land, being carried thence by Eskimo to the Government station at Fullerton, on Hudson bay, and so passed on to Quebec. The first letter was written on November 24, 1904, and briefly describes the voyage from Godhavn, July to September, 1903, and the work carried on during the past year in the region of King William's Land. At Beechey island, which was reached on August 22, 1903, magnetic observations were made, which pointed to the pole being in a southerly direction, in which the voyage was therefore continued through Lancaster and Peel sounds. At Prescott island in the latter the compass finally failed, but the voyage was continued (amid some danger from fog, snow, and ice) through Bellot straits, along the west coast of Boothia, and through Simpson strait to Pettersen bay in King William's land, where winter quarters were established at Gjöa harbour, which proved excellently fitted for the purpose. The various scientific observations were established and observations commenced on November 2. The winter passed satisfactorily, though seven of the best dogs were lost. During a preliminary tour in March, the very low temperature of $-61\cdot7°$ C. ($-79°$ Fahr.) was experienced. The sledge expedition to the region of the pole itself was carried out in April and May, but of its results Captain Amundsen does not yet speak. The summer (which was unusually cold and rainy) was spent by him in magnetic observations about the station. On the breaking up of the ice, Lieut. Hansen and Helmer Hansen went westward through Simpson strait in a boat to explore its most narrow part, and put down stores for a projected sledge journey to the west coast of Victoria Land in the spring of 1905. The second letter is dated May 22, 1905. During the second winter, which was by no means so hard as the preceding, the observations were kept up without intermission, while in April Lieut. Hansen and Sergeant Ristvedt started to draw a map of the east coast of Victoria Land.

Drift-casks and Polar Currents.—Some years ago we referred (*Journal*, vol. **12**, p. 194; vol. **14**, p. 326; vol. **18**, p. 627) to the scheme, first suggested by Admiral Melville of the U.S. Navy, and carried out largely through the energetic support of Mr. H. G. Bryant, for the elucidation of polar currents by means of specially constructed casks set adrift at various points on the fringe of the Arctic ocean. After some years' waiting, the labours of the promoters of the enterprise have at last met their reward in the recovery of one of the casks, which had made a voyage of some 3000 miles across the whole width of the Arctic ocean before being again heard of. The announcement of this satisfactory result was made to the Geographical Society of Philadelphia by its president, Mr. Bryant, on November 1, a short statement of the circumstances appearing the following day in the *Philadelphia Press*, a cutting from which has been sent to us. The first cask to be recovered was one cast adrift by Captain Tuttle, of the U.S. Revenue cutter *Bear*, on August 21, 1901, about 85 miles north-west of Wrangel Island, and found a year later on the Siberian coast after completing only a comparatively short transit. The second cask was not brought to light until June 7 of the present year, when it was found one mile east of Cape Rauda Nupe, on the northern coast of Iceland. It had been set adrift as far back as September 13, 1899, when it was placed on the floe ice north-west of Point Barrow, Alaska, in 71° 53′ N., 164° 50′ W., by Captain B. T. Tilton, of the steam whaler *Alexander*. The existence of a current setting right across the north polar basin is thus once more triumphantly demonstrated. The precise route followed by the cask cannot, of course, be determined, but judging from the case of the *Jeannette* and *Fram*, it would seem probable that it lay on the Asiatic side of the pole, describing a curve concave towards the side of North America. It is hoped that others of the casks may eventually be recovered, their great strength and specially designed shape fitting them well to withstand the buffeting to which they are subjected.

Peary's New Expedition.—News of the safe arrival of Commander Peary at Etah, North Greenland, has been brought home by the *Erik*, which had gone north with coal supplies for the *Roosevelt*. The voyage had been carried out under very favourable conditions, and a number of Eskimo families had been picked up *en route*. They were in an unusually prosperous state.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

The Indian Ocean Expedition.—A further account of the work of this expedition, sent home by Mr. J. Stanley Gardiner, is printed in *Nature* for November 9. On September 12, when the letter was written, Mr. Gardiner was at Coetivy, the most southerly island of the Seychelles group. His former communication (November number, p. 561) had announced the arrival, early in August, at Mauritius, and the intervening time had been spent in examining the reefs around that island, and in working up thence towards the Seychelles. The Mauritius reefs vary from fringing to barrier, the best example of the latter being at Grand Port, where (4 miles from the land) there are some small islets, probably representing the remains of a considerable island, elevated for at least 100 feet. The outer contour of the reefs of Mauritius is the same as that off atoll reefs, viz. a gradual slope to 40 fathoms, a steep drop to 150 fathoms, and a gradual fall to 1000 fathoms in 5 miles. Between the island and Cargados there was a depth of 1962 fathoms, there being no marked connecting ridge, but a gradual slope from each side. Cargados is a crescent-shaped surface reef 31 miles long, on the south part of the Nazareth bank, on which there is an average depth of 33 fathoms. The land is coral rock, with no signs of elevation. A slight decrease towards the western edge of the bank suggests an incipient atoll, and here the bottom was entirely formed of coral-rubble of a bright red colour, the result of an encrusting nullipore. From this rubble a rich variety of animal life, almost all the forms tinted with red, was obtained. In the channel between the Nazareth and Saya de Malha banks (the latter of which really consists of three separate banks) a depth of 222 fathoms was found, the connection being a ridge rapidly falling on the west to more than 800 fathoms. All the three sections of Saya de Malha are of more or less atoll form, but the south side of the central bank is exceptional in its gradual slope. Between these banks and that surrounding the Seychelles, the greatest depth found was 961 fathoms. The existence is thus proved of a crescent-shaped ridge 1100 miles long, with less than 1000 fathoms of water, arising on either side from a general depth of 2200 fathoms. On the return of the ship from coaling, it was proposed to examine the line connecting the Seychelles with Madagascar.

The Meteorological Station at the South Orkneys.—It will be remembered that on the return of the Scottish Antarctic Expedition, the meteorological station which had been established by the explorers at Scotia bay in the South Orkneys was taken over by the Argentine Government. The observations have been regularly carried on, and the station will be maintained for another year at least. The charge of it has lately been entrusted to Mr. Angus Rankin, who left Edinburgh for the Antarctic to take up the work on October 11. He is accompanied by Messrs. R. H. MacDougall and William Bee, both of whom have gained experience of meteorological work at the station on Ben Nevis.

Underground Temperature.—We learn from the *Zeitschrift* of the Berlin Geographical Society (1905, No. 6) that a proposal has been made by Prof. G. K. Gilbert to the Carnegie Institution in Washington for the systematic investigation of the increase of temperature below ground by means of deep borings in volcanic rock. It is suggested that the first boring should be made in Georgia, in a very compact granite, which it is proposed to pierce to a depth of some 3500 feet.

GENERAL.

The Ancient Trireme.—In spite of the amount of discussion bestowed upon the ancient trireme of the Greeks, it cannot be said that a satisfactory solution of the question has hitherto been arrived at. The usual idea that a trireme was a vessel with three tiers of rowers, one above the other, working oars of three different lengths, is at once seen to be quite impossible by any one possessing a practical acquaintance with nautical affairs; but although other more rational explanations have been put forward, none has entirely met all the difficulties. Perhaps the most satisfactory solution of the problem is that put forward by Mr. A. B. Cook, Fellow of Queen's College, Cambridge, who briefly reviews the whole question in the *Mid-Tyne Link* (Newcastle-on-Tyne, vol. 2, No. 6, 1905). Mr. Cook has been fortunate in securing the co-operation of a practical shipbuilder, Mr. Wigham Richardson of Newcastle-on-Tyne, who has superintended the construction of a model to illustrate Mr. Cook's views, photographs of which accompany the paper, and materially aid in rendering the suggestions intelligible. While allowing that in the latter days of the Greek period the vessels designated six-fold, seven-fold, and over, may have been propelled by a single tier of oars, each worked by six, seven, or more men, Mr. Cook holds that the view that all the Greek vessels had only one tier is equally untenable with the popular notion of three or more independent rows. He believes that the correct solution was closely approached by Admiral Fincati of the Italian navy ('Le Triremi,' 2nd edit., Rome, 1881), who, arguing from what is certainly known of the Venetian triremes of the sixteenth century, came to the conclusion that among the Greeks too the triremes were worked on a system of grouped oars, three oars passing through a common porthole, and three oarsmen being assigned to each bench. As to the precise method of grouping, some doubt may exist, but the most probable arrangement seems to be that in which the three rowers were placed slightly *en échelon*, and on slightly different levels—the innermost of course highest. The terms "thalamite," "zygite," "thranite" become thus intelligible as the rowers who sat respectively next the porthole (*thalamia*), on the beam (*zygon*), and on a raised stood (*thranon*). Mr. Wigham Richardson adds some notes explanatory of the model, which has been constructed on the scale of an inch to a foot. The length chosen for the middle oars is 12 feet, or about the length of those used in racing-boats at the Universities, but it is pointed out that any length up to 16 feet (reached sometimes in the modern lifeboat) would be possible. In order to give each rower the same stroke, whatever the length of the oars, the centres of the thole-pins would, in each group, be placed *en échelon* on a wide gunwale-rail. An upper deck would doubtless be developed sooner or later.

The Cause of "Beri-beri."—The cause of this troublesome disease, which plays such havoc in many parts of the Eastern tropics, has hitherto baffled the researches of scientists, though various hypotheses have been put forward on the subject. While some observers have supposed that diet plays an important part in the contraction of the disease, others, like Dr. Hamilton Wright, who attributes it to the presence of a specific germ, deny that food has anything to do with the matter. Dr. C. Hose, the well-known resident at Sarawak, Borneo, who is a believer in the importance of diet in the matter, has lately given his reasons for his belief in the *British Medical Journal* (October 28, 1905). While not denying that a bacillus of the disease may exist, Dr. Hose holds very strongly that the connection between beri-beri and the consumption of mouldy rice is one which cannot be ignored, and he certainly makes out a strong case in support of this view. He gives various instances, many from his own observation, of the consumption of such rice being accompanied by outbreaks of the disease, while the use of freshly husked rice has either been attended by immunity, or has led to recovery on the part of those already attacked. He shows how generally the attacks of the disease coincide with the period in which imported rice—probably kept in bags for weeks before it is used, and so particularly liable to become musty —has chiefly to be depended on. A minute fungoid growth has been proved to exist on rice of this description, which, when given to apes or fowls, has led to symptoms closely resembling those of beri-beri. In this fungus, the existence of which (or of a closely similar growth) he has also demonstrated in the case of maize, sago-flour, and even of dried fish, Dr. Hose sees the probable cause of the disease. It is to be hoped that further light may before long be thrown on the subject, and should Dr. Hose's view prove to be correct, he will have conferred no small benefaction on the lands subject to the ravages of the disease.

OBITUARY.

Ferdinand Freiherr von Richthofen.

By E. G. Ravenstein.

On Saturday, October 6, there succumbed to an apoplectic stroke and passed away peaceably Ferdinand Freiherr von Richthofen. With him one of the most gifted representatives of the geographical science of the age has gone from among us, equally respected and beloved by numerous pupils who had profited directly by his teaching, as by the far larger bodies of geographers, who appreciated the high value of his labours. Richthofen was born on May 5, 1833, at his father's country seat near the village of Karlsruhe, in Silesia. Having passed through the Catholic gymnasium of Breslau, he entered upon the study of geology, first, in 1850, at the university of the capital of Silesia, and since 1852 at Berlin, where he attended the lectures of the geologists H. E. Beyrich and C. S. Weiss, and of Carl Ritter, the famous geographer, and where, in 1856, he graduated on the strength of a dissertation 'De Melaphiro.'

In the summer of that year he begun geological researches in the Tyrol, which subsequently, under the auspices of the Imperial Geological Institute, were extended to the trachytic mountain ranges of Hungary and Transylvania. In the Tyrol he devoted himself more especially to an examination of the Limestone Alps of the north and the Dolomites of the south-east, and in his 'Geologische Beschreibung der Umgegend von Predazzo,' published at Gotha in 1860, he put forth the view that the Dolomites had their origin in coral reefs, a view not generally accepted at the time by geologists, but successfully upheld by him in a paper on the Dolomites of Mendola and Schlern published in the *Zeitschrift* of the German Geological Society in 1874.

In 1859, when the Prussian Government sent F. A. Count von Eulenburg on a diplomatic and commercial mission to Eastern Asia, Richthofen was invited to accompany him as geologist. He gladly embraced this opportunity for extending his knowledge, and, leaving Triest in May, joined the mission by the overland route. The dilatory proceedings of the diplomats afforded ample leisure to the scientific members of the mission, and of this Richthofen availed himself to the full. Ceylon he had already got to know on the outward journey, in June, 1860; to Japan he was able to devote several months, and he was also afforded facilities for paying shorter visits to Formosa, the Philippines, and Java, in which latter, jointly with Junghuhn, between September 9 and October 26, 1862, he visited the volcanoes of the Preang "Regencies." He rejoined the main body of the mission at Bangkok on November 21, and after the departure of the vessels for Europe on February 16, 1862, he travelled by an unexplored inland route to Maulmain, and proceeded thence to Calcutta, where he arrived on April 21, 1862. China at that time being inaccessible owing to the Taiping rebellion, and a return to Europe either by way of Kashmir and Turkistan, or of the Amur and Siberia, being thought impracticable or unpromising from a scientific point of view, Richthofen, in June, turned his back upon Asia and sought a fresh field of research in California, which he only left again in August, 1868. The conclusions arrived at from an examination of the metalliferous mountains of California and the neighbouring territories were made known through a volume on 'The Natural System of Volcanic Rocks' (San Francisco, 1867); * but apart from a few papers in the *Zeitschrift* of the German Geological Society, vols. 12–14, and in *Petermanns Mitteilungen* (1862, p. 420), no account of his earlier travels in South-Eastern Asia has been published.

In the mean time the Taiping rebellion in China had been suppressed, the country was once more accessible to travellers, and Richthofen was thus able to enter upon the task he had set himself when he left Europe, namely, the comprehensive geological exploration of the great empire of the East. On September 5, 1868, he landed at Shanghai, and in the course of seven journeys he traversed nearly every province of China. Kan-su and Yun-nan, however, which latter he had hoped to enter by the route followed more than six centuries before him by Marco Polo, proved inaccessible owing to the Mohammedan rebellion. On May 21, 1872, he was back at Shanghai, and soon afterwards he returned to Europe.

Richthofen, as a geologist, naturally paid especial attention to the geology of the country, concerning which but little was known in his day, but he did not neglect other subjects of inquiry, as is proved by seven letters which he addressed to the Shanghai Chamber of Commerce, which had borne part of the expenses of his mission.† In the baron's opinion, "China is materially one of the most richly endowed countries of the world, a country of vast resources, and of a future incalculably great and important."

Immediately on his return to Europe Richthofen set about to prepare an account of his travels and researches, which, thanks to the liberality of the late Emperor William, was planned on a monumental scale. The first volume, a huge quarto, appeared in 1877. It presents us first with a general account of the morphology and geology of Inner Asia and China, and, secondly, with the history of China's relations with the outer world. It is a work of remarkable research and originality, and fully entitled its author to the Society's Founder's Medal, which was awarded him in 1878. A second volume, dealing in detail with northern China, and accompanied by an Atlas of hypsographical and geological maps, was published in 1882; the fourth volume, containing papers on Palæontology by specialists, followed in 1883; but neither the second volume, which was to have been devoted to southern China, nor the second part of the Atlas, have ever been published. His cartographical materials have, however, been utilized in the map of Eastern Asia, on a scale of 1 :1,000,000, published by the Prussian Survey Office since 1901.

It was Richthofen who first directed attention to the importance of the coal-fields of Shan-tung, and pointed out the importance of Kiou-chau as a commercial

* See also a Statistical Paper on the Production of Gold and Silver of California, printed as a supplement to *Petermanns Mitteilungen*, 1864.

† These 'Letters on China' were published at Shanghai, 1870-72. A reprint appeared in 1900.

Photograph by Messrs. Thomson.

FERDINAND BARON VON RICHTHOFEN.

port. After the occupation of that port by Germany, he published 'Schan-tung und seine Eingangspforte Kiou-tshou' (Berlin, 1898). Still more recently he published 'Geomorphological Studies in Eastern Asia' ('Sitzungsberichte' of the Berlin Academy, 1900–1902), of which an excellent summary, by Prof. K. Futterer, has appeared in *Petermanns Mitteilungen*, 1901–1903. As a further outcome of the experience gained as an explorer, we must look upon the paper on "Geology" which he contributed in 1875 to Prof. G. von Neumayer's 'Anleitung zu wissenschaftlichen Beobachtungen auf Reisen,' an enlarged edition of which was published in 1886 under the somewhat too comprehensive title of 'Führer für Forschungsreisende.'

If Richthofen's merits as a scientific explorer were of a high order, the services which he rendered as a teacher and as a leader of thought must rank at least equally high. The Berlin Geographical Society, which elected him as its president almost immediately after his return from China, in 1873, has enjoyed the benefit of his services up to the time of his death; the International Geographical Congress which met at Berlin in 1899, owed much of its success to his gift of organization and the charm of his personality, which also stood him in good stead when, in 1903, he was entrusted with the establishment of an Oceanological Institute.

Richthofen entered upon his professorial career at Bonn in 1879;* succeeded Peschel at Leipzig in 1883, and followed a call to Berlin in 1886, where he remained up to the time of his death. Addresses delivered at Leipzig on April 27, 1883, and at Berlin, upon his election as Rector of the University, on October 15, 1903, afforded him opportunities for making known his views on the Problems and Methods of Geography as a Science.† According to him, the domain proper of the geographer is the surface of the Earth (including the lithosphere, hydrosphere, and atmosphere), and the study of objects and phenomena in their causal relations to it. He distinguishes between Special Geography or Chorography, General Geography, and Chorology. Special geography is merely preparatory, concerns itself with the collection of facts, and is synthetic in its methods. General geography analyzes these facts and groups them according to their various categories; it divides itself into physical geography, biological geography (the distribution of plants and animals), and anthropogeography. Chorology, lastly, represents the culminating point of the science, by determining the causal connections between all phenomena hitherto recorded and classified. These should be considered from morphologic, hydrologic, dynamic, and genetic points of view, as in other sciences. I quite agree with Baron Richthofen when he maintains that geographers should make themselves masters of at least one of those cognate sciences which surround, and in many cases encroach upon, the field which geographers generally claim as exclusively their own, and that among these sciences geology holds the foremost place.

At Berlin, during last "Semester," Prof. von Richthofen lectured four times a week on Western Asia; twice weekly he presided at a "colloquium," or discussion class; and he likewise superintended the instruction given in the use of scientific instruments, the construction of maps, and in practical field-work. These, however, were not the only opportunities which the University afforded to geographical

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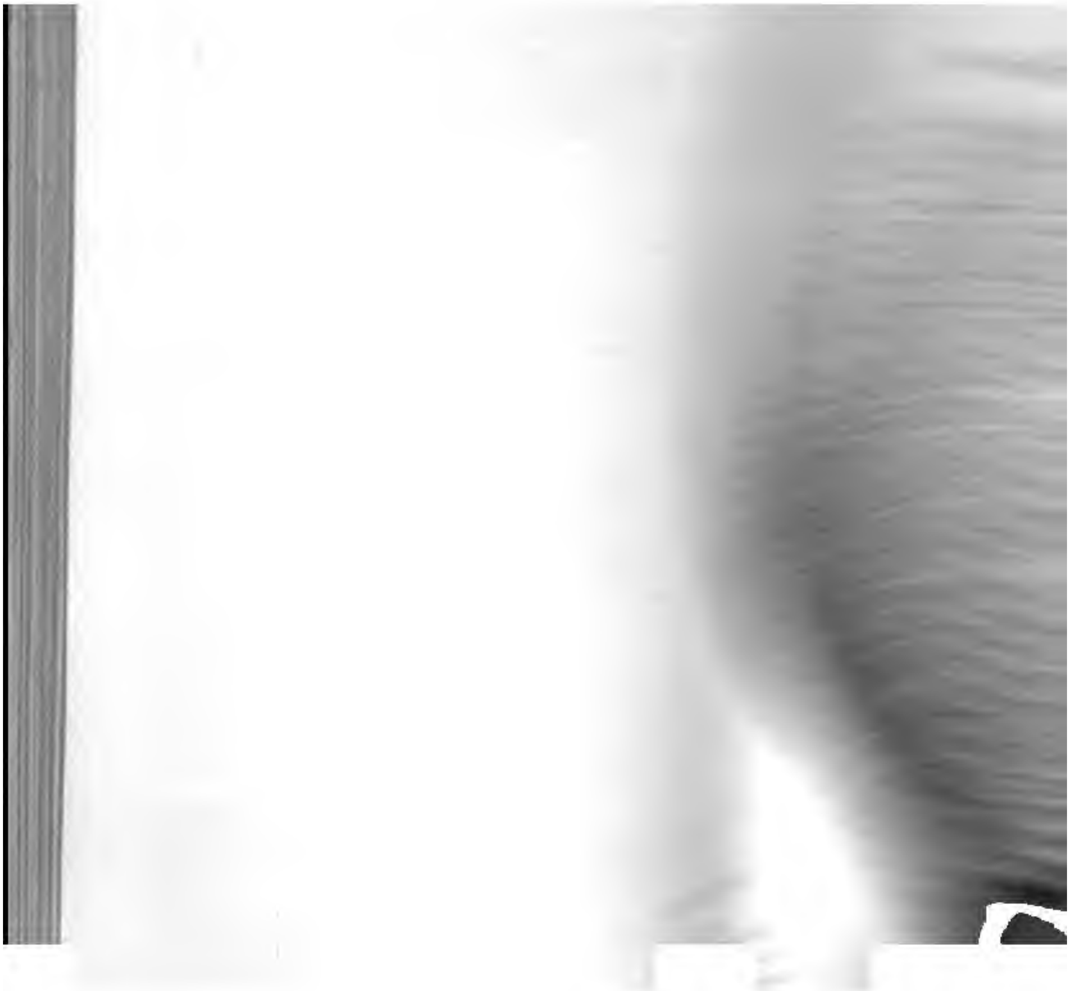
* He was appointed in 1875, but permitted to defer entering upon his duties until he should have completed the first part of his great work on China.

† 'Aufgaben und Methoden der heutigen Geographie,' Leipzig, 1883; and 'Triebkräfte und Richtungen der Erdkunde im 19ten Jahrhundert,' Berlin, 1903. For excellent reports on geographical methods by Dr. H. Wagner, see the *Geographische Jahrbuch*, 7 to 10, 1878-84.



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[illegible]ed the Ordnance [illegible]y at Dublin in 1885, and

students, for, in addition to Baron von Richthofen, there were nineteen professors or teachers on the staff who lectured on geography or on subjects of direct interest to them.

That Richthofen was greatly respected and beloved by his old pupils is proved by the "Festschrift" * which they presented to him on his sixtieth birthday, and which contains contributions by Drygalski, A. Hettner, G. Schott, K. Kretschmer, E. Hahn, G. Wegener, H. Yule Oldham, and others; and that his labours were appreciated also in much wider circles was shown on his seventieth birthday in 1903, when 700 admirers in every part of the globe raised the sum of £1300 as a "Richthofen Stiftung," the interest of which is to be devoted to young geographers for the promotion of scientific research.

Major-General Sir Charles William Wilson, K.C.B., K.C.M.G., F.R.S., etc.

By the death of Major-General Sir Charles Wilson, which occurred at Tunbridge Wells on October 25, 1905, the Society has lost one of its most distinguished fellows and warmest supporters. Charles William Wilson was born on March 14, 1836. He passed second into Woolwich, and received his first commission in the Royal Engineers on September 24, 1855. He earned distinction in various ways, but he was, before everything, a surveyor and cartographer, and a large proportion of his long service was passed either in survey work or as head of the Topographical Branch of the War Office, while his very able administration as Director-General of the Ordnance Survey has been recognized by those who best knew the difficulties he had to contend with.

He was started early in his service on survey work, having been appointed in the beginning of 1858, while still a young subaltern, to the North American Boundary Commission, to which was entrusted the survey and demarcation of the boundary between British Columbia and the United States. He served with great ability with this commission till late in 1862. He received the thanks of the Foreign Office for his services.

It having been decided to make a contoured survey of Jerusalem, Wilson, who had just been promoted captain, volunteered at some pecuniary sacrifice to take charge of the survey, and his services were accepted. He proceeded to Jerusalem in 1864. Besides the actual survey, Captain Wilson undertook considerable underground explorations, and made many interesting discoveries. The Royal Society and the R.G.S. subsequently proposed that the opportunity should be taken of connecting the Dead sea by levelling with Jerusalem and the Mediterranean, thus ascertaining the correct level of the former. This survey was executed by Captain Wilson, who completed it, and returned home in July, 1865. Both surveys were successfully carried out, and required not only technical skill, but the exercise of great tact and judgment. It was probably the first instance of a considerable survey carried out in a country under Moslem rule, but so tactfully was it managed that Wilson and his surveyors were allowed to go anywhere, and were on the best terms with the inhabitants. Captain Wilson, who was a clear and attractive writer, gave an account of this work in his 'Notes on the Ordnance Survey of Jerusalem.'

Shortly after his return home, Captain Wilson was posted to the Ordnance Survey and joined at Inverness; but his stay on the Ordnance Survey was short, as he returned to Palestine in November, 1865, to take charge of an expedition

* Berlin, 1893.

organized by the Palestine Exploration Fund, of which Sir C. Wilson has been a mainstay ever since. This expedition made a reconnaissance of the country, fixed a number of places astronomically, and made considerable archæological researches. This expedition was the starting-point of the Palestine exploration, and Captain Wilson rejoined the Ordnance Survey in 1866. He acted as assistant Commissioner to the Bonyl Boundary Commission in 1867.

In 1868, a survey of Mount Sinai and of the adjoining country in which the wanderings of the Israelites took place was projected, and this survey was undertaken and skilfully carried out by Captain Wilson and Captain Henry Palmer, R.E., assisted by several scientific men and by a party of surveyors from the Ordnance Survey. An interesting account of this survey is given in 'Notes on the Ordnance Survey of Sinai,' by Captain Wilson. For his services in connection with these surveys Captain Wilson was elected a Fellow of the Royal Society. He was also elected to the Council of the R.G.S. and to several foreign societies.

In 1869, Captain Wilson joined the Topographical Department of the War Office, and shortly after was appointed director of that department. On the formation of the Intelligence Branch of the War Office, Captain Wilson was made its chief, with the rank of Assistant Quartermaster-General of the Intelligence Department. He held this appointment, with the approbation of his superiors, till 1877; his services were rewarded by the grant of a Companionship of the Bath.

In 1871 Captain Wilson received the Diploma of the International Geographical Congress at Antwerp for his work in the Holy Land.

On leaving the War Office, Wilson, who had meantime been promoted major, was specially employed for a short time under the India Office, in connection with Afghan affairs, and was subsequently reappointed to the Ordnance Survey, and placed in charge of the Dublin office.

In 1878 he temporarily left the Ordnance, on appointment as British Commissioner for demarcation of the Servian boundary, under the Treaty of Berlin. For his services he was given a brevet as lieut.-colonel, and received the thanks of Government.

In 1879 Lieut.-Colonel Wilson left the Ordnance Survey to take up the appointment of consul-general in Anatolia, and while so employed collected much valuable geographical information in spite of the arduous nature of his duties. He was, while so employed, sent on a special commission to Bulgaria, Roumelia, and Macedonia, and also on a mission and consular posts in Syria, Palestine, and Asia Minor. In these services he was made a K.C.M.G., and received the thanks of Government; he was also given the honorary degree of D.C.L. Oxford.

He was employed on special service under the Foreign Office during the Egyptian campaign of 1882, and on the conclusion of the campaign was attached to Lord Dufferin's special mission. He received the thanks of Government for his general services, and also specially in connection with the trial of Arabi Pasha. On his return home he was reappointed to the Ordnance Survey at Dublin.

In the campaign for the relief of General Gordon in 1884, Colonel Sir Charles Wilson was appointed Deputy Adjutant and Quartermaster-General of the Headquarters Staff. He was present at the principal actions of the campaign, and when Sir Herbert Stewart was wounded, he succeeded to the command of the Desert Column. After the action at Metemmeh, he made a bold attempt to communicate with General Gordon. Starting by steamer, with a few British soldiers and less than two hundred Sudanese, he fought his way to Khartum, only to find that the gallant Gordon had been already killed.

For these services he received the thanks of the Government and a K.C.B. Colonel Sir Charles Wilson rejoined the Ordnance Survey at Dublin in 1885, and in November, 1886, he was appointed Director-General of the Ordnance Survey, in succession to Colonel R. H. Stotherd, C.B., R.E. He took over charge of the Ordnance Survey at a very anxious and critical period. The Cadastral Survey of Great Britain was approaching completion, and revision had not yet been authorized. The future of the Ordnance Survey was very uncertain, and this uncertainty had naturally unsettled the staff, and there was a good deal of discontent. Sir Charles Wilson tackled the difficulties which confronted him with ability, boldness, and judgment. He obtained authority in 1887 to revise the Survey of Ireland on the 1 : 2500 scale, instead of the 6-inch scale, and a similar revision of Yorkshire and Lancashire and of the south of Scotland, which so far had only been surveyed on the 6-inch scale, was prosecuted vigorously by him. It was during his tenure of office that the revision of both large-scale and small-scale maps of the Ordnance Survey was authorized. The large-scale revision was hardly commenced during his tenure of office, but the revision of the 1-inch maps, some sheets of which had not been revised for sixty or seventy years, was undertaken independently of the large-scale maps, and this revision, the arrangements for which were made under his supervision, made considerable progress during his time. It was due to the arrangements he initiated that the Ordnance Survey maps are now always to be had reasonably up to date.

Sir Charles Wilson's administration of the Ordnance Survey entitles him to rank as one of the ablest heads of that department. He was an able administrator, and a clear and vigorous writer. He was always considerate to those under him, took great interest in their welfare, and spared no trouble to further their interests. He gained the esteem and confidence of all who served under him.

He was given the temporary rank of major-general in 1893, and the permanent rank in 1894, and shortly after vacated his appointment as Director-General of the Ordnance Survey to the regret of all who had served under him.

He was not allowed to be long unemployed, as, early in 1895, he was appointed Director-General of Military Education, a post he held until his retirement under age rules in 1898.

After his retirement he continued to take a keen interest in the work of Palestine exploration, and besides acting as chairman of the Exploration Fund, he wrote a good deal on the subject, and made a visit to the Holy Land. He also retained his interest in the R.G.S., although, owing to his living out of London, he found it necessary to resign his seat on the Council. From 1872 onwards he had served frequently on the Council, and was for many years a Vice-President of the Society.

A man of great ability and of very varied attainments, but withal extremely modest and retiring, he gained the regard and affection of all who knew him, and his loss will be regretted by many Fellows of the Society and by many in the country generally who, although not knowing him personally, knew and admired the splendid work he had done. His funeral was attended by representatives of the R.G.S., the War Office, the Palestine Exploration Fund, and by many friends.

D. A. J.

Admiral Sir W. J. L. Wharton, K.C.B., F.R.S.

William James Lloyd Wharton, second son of the late Mr. Robert Wharton, County Court Judge of York, was born in London on March 2, 1843. Educated at Burney's Academy, Gosport, he entered the Royal Navy in August, 1857. Passing in seamanship for the rank of lieutenant on January 13, 1863, he was appointed acting-lieutenant of H.M.S. *Jason* on October 26, 1864, and returned to England in that ship towards the close of the year, when he completed the necessary examinations in gunnery and navigation, in which he acquitted himself brilliantly, being awarded the Beaufort Testimonial for passing the best examination of his year in mathematics and nautical astronomy. Confirmed in the rank of lieutenant, March 15, 1865, he was appointed to H.M. surveying vessel *Gannet* on the North American and West Indian stations, where he received the commendation of the Board of Admiralty for the zeal displayed by him on the work performed in the Bay of Fundy. The ability and industry shown by Lieut. Wharton while serving in the *Gannet*, as well as the distinction he had gained in passing his examinations, aroused the interest of the commander-in-chief, Vice-Admiral Sir James Hope, who, on hoisting his flag at Portsmouth, nominated him as his flag-lieutenant. While so employed he wrote 'The History of H.M.S. *Victory*.' On Sir J. Hope striking his flag, he was promoted to commander, March 2, 1872, and the following month was appointed to the command of H.M. surveying vessel *Shearwater*, first on the Mediterranean station, and afterwards on the east coast of Africa. In the Mediterranean his work was chiefly distinguished by a valuable contribution to science in the form of an investigation of the surface and undercurrents in the Bosphorus, setting at rest the many controversies respecting the flow of water from the Black sea to the Sea of Marmora. In June, 1876, he commissioned the *Fawn* for surveying service in the Mediterranean, Red sea, East Coast of Africa, and Sea of Marmora. During a prolonged commission of four and a half years, whilst exacting the utmost each individual was capable of giving to the service, he nevertheless endeared himself to all under his command. A large amount of valuable work was accomplished, and on the conclusion of the survey of the Sea of Marmora, he and his officers received an expression of their lordships' approbation. He was promoted to captain, January 29, 1880.

During an interval of leisure following the *Fawn's* commission, Captain Wharton published 'Hydrographical Surveying,' which was at once recognized as the standard work on the subject.

In March, 1882, he commissioned H.M.S. *Sylvia* for surveying service in the river Plata and Straits of Magellan, and after two seasons in the inhospitable climate and dangerous waters of the western part of the Straits of Magellan, he returned to England to assume the duties of hydrographer on August 1, 1884, at an age younger than that of any officer who had held that responsible position.

Wharton's administration of the hydrographical department of the Admiralty continued uninterruptedly for twenty years with constantly increasing credit, and to the great advantage of our own navy as well as to the whole maritime world. During this period the number of chart plates was largely increased, and the number of charts printed annually for the fleet and for sale to the public multiplied threefold. Gifted with an extraordinary capacity for work, he never spared himself; the sound judgment, breadth of view, and wide scientific attainments constantly brought to bear upon the infinite variety of subjects with which he was daily called upon to deal, secured for him the respect and confidence of successive Boards of Admiralty. An especial characteristic was the readiness with which the mass of information he had acquired on all sorts of subjects was available on the spur of the moment. Scientific subjects of whatever nature bearing on hydrography always claimed his attention, and in 1886 he was elected a Fellow of the Royal Society, serving on its council from 1888 to 1889, again from 1895 to 1897, and, being again elected in 1904, was a member until his death.

As Fellow of the Royal Astronomical Society, as well as of the Royal Geographical Society, as Vice-President of the latter, and member of numerous committees, he did work only less important than his official work at the Admiralty. He contributed to the literature of the Royal Society an investigation of the great waves produced by the eruptions of Krakatoa in 1882, and in 1893 he edited the 'Journal' of Captain Cook during his first voyage round the world. At the meeting of the British Association at Oxford in 1894, he presided over Section E. The investigation of the origin and formation of coral reefs was a subject of especial interest to him, and he advanced a theory, based upon the results of surveys of large numbers of these reefs, that the effect of wave-action was mainly accountable for the striking uniformity of depth so frequently met with over the interior of coral banks in the open ocean, showing that wave-action in the open ocean extended to greater depths than was hitherto considered possible.

Keenly interested in the project for Antarctic exploration, he took a very active part as a member of the joint committee of the Royal Society and Royal Geographical Society appointed to organize it. He was placed on the retired list in 1891, in accordance with the regulations respecting non-service at sea. Promoted to rear-admiral on January 1, 1895, on the Queen's birthday that year he was nominated C.B. On the occasion of the Diamond Jubilee, in 1897, he was created K.C.B.

On July 31, 1904, Sir William Wharton resigned the office of hydrographer. In July last he accepted, with some hesitation, the reiterated invitation to go out to South Africa with a party of members of the British Association, and he presided over Section E at Cape Town. Unfortunately, he fell ill on the return journey from the Victoria falls. His illness, which was at first thought to be a chill, proved to be enteric fever, complicated with pneumonia, and although no effort was spared to effect his recovery, he died at the Observatory at Cape Town on September 29. He was buried at the naval cemetery at Simon's Town on October 1, with naval honours, H.M. the King being represented by the commander-in-chief of the station. He was married, in 1880, to Lucy Georgina, daughter of Mr. Edward Holland, of Dumbleton, in Gloucestershire, and by her, who survives him, he had two daughters and three sons, two of whom are now serving in H.M.'s Navy.

A. M. F.

CORRESPONDENCE.

Marco Polo's Travels.

Paris, 54 Rue Nicolo, November 12, 1905.

On my return from South Africa, I find in the October *Journal* two notes from Major P. Molesworth Sykes regarding Marco Polo's travels. I have not time at present to enter fully into the question, which I shall do later on, but I may be allowed to make the following remarks.

I have not attached, and do not attach, the slightest importance to the neglect, it is not *supposed*, of a draughtsman who had only to follow the author's text. When Major Sykes writes that "the fact" that Baghdad was not more important than Tabriz at the time of Marco Polo's voyage *outward*, say 1271, "is not fully proved," it shows that he has not studied the question. Baghdad, after its fall in 1258, did not cease immediately to be "rather off the main caravan route." I shall not refer Major Sykes to what I say in my editions of 'Odorico' and 'Polo' on the subject, but to the standard work of Heyd, 'Commerce du Levant,' vol. 2, pp. 77, 78. The itinerary, Tabriz, Sultania, Kashan, Yezd, was the usual route later on, at the beginning of the fourteenth century, and it was followed, among others, by Fra

Odorico, of Pordenone. Marco Polo, on his way to the Far East—you must not forget that he was at Acre in 1271—could not have crossed Sultania, which *did not exist*, as its building was commenced by Arghùn Khan, who ascended the throne in 1284, and was continued by Oeldjaitu (1304–1316), who gave the name of Sultania to the city.

With regard to the second part of the letter of Major Sykes, who in his book wrote that "it is practically certain that Marco Polo ended these unpleasant experiences at Tabas," I am quite willing to accept the new and highly probable theory, founded on personal experience, that "it is almost certain that Ser Marco travelled to Tun, as Tabas falls to the west of the main route." Cf. Curzon's map of Persia.

HENRI CORDIER.

"The Nile in 1904."

A long absence from home has prevented me from answering at an earlier date the criticism of my book, 'The Nile in 1904,' by Captain H. G. Lyons, in June of this year.

The first criticism runs thus—

"Lado is taken as 447 metres instead of 465, but no reason is given for preferring the lower value."

On page 14 of my book is the following:—

"4. *The Slopes and Velocities of the Nile in its Different Reaches.*—Table II. of Appendix B and Plate II. comprise all the information available under this head which I have been able to collect. For the slopes I have adopted the following data:—

"R. L. of Lake Victoria	...	1129 metres above mean sea
" Fowera ...	...	1060 " ,
" Lake Albert ...	...	680 " ,
" Khartum (flood)	...	389 " "

"From Khartum to Wady Halfa I have adopted the generally accepted levels of the original Sudan railway survey. From Wady Halfa to the sea I have levelled myself. Upstream and downstream from the adopted levels I have carried the levels by the aid of slopes calculated from velocity and hydraulic mean-depth data. It seems to me absurd to adopt a level for Lake Choga 50 metres above that for Fowera, and then to add, that in the 140 kilometres between the two places the Victoria Nile has a gentle slope, wide bed, and gentle velocity."

The second criticism is as follows:—

"The rainfall of the basin is very superficially dealt with, considering its importance and the large increase of data in the last ten years. Several errors are due to this, and the basin of the Blue Nile in Abyssinia is credited with a good rainfall throughout nine months of the year, which is probably based on that of Adis Abeba on the eastern escarpment; but all over the tableland there is a sharply defined period of four months, only extending to five in the more southern parts."

On page 19 of my book is the following:—

"The Abyssinian part of the catchment basin of the Blue Nile enjoys a good rainfall throughout nine months of the year from February to October, with generally heavy rain between May and September, and very occasionally in October. The rainfall here may be taken as 1·25 metre per annum. In the plains of the eastern Sudan traversed by the lower reaches of the Blue Nile and the Atbara the rainfall is very much lighter, and may be considered as 30 centimetres between July and September; fairly constant and heavier in the south, and very inconstant and lighter in the north. The Atbara and its tributaries, in their upper reaches on the northern slopes of Abyssinia, have rain from May to the end of August, and occasionally into September. There are great fluctuations in the rainfall. The mean annual rainfall may be taken as 75 centimetres."

The Italian meteorologists supplied me very kindly with full information about the rainfall, and I had, moreover, accounts of various travellers. When ordinary and heavy years of rainfall succeed to the extraordinary low rainfall of the last seven years (1899–1905), Captain Lyons may find that I am nearer the truth than he is.

The next mistake Captain Lyons found is the following :—

"The regulating action of Albert lake is said to be such that the floods of the Victoria Nile are delayed five months in their passage down the Bahr el Jebel; but this seems to be an assumption based on the maximum level of the lake being reached in December, while the Victoria lake is usually highest in June. The effect of the rainfall of this region has, however, been misunderstood. The discharge of the Victoria Nile after passing through Lake Choga becomes practically a constant amount, and it is the rainfall on the hills north of Foweira which causes the flood in the lower reaches near the Murchison falls. This rainfall begins about June and ends in October, while at the south end of the Albert lake it is heaviest in May and November, so that the combined effect is to produce a rise in the Albert lake, and at Wadelai from May to December."

I had stated on page 30—

"A reference to Plate V. will show how great is the regulating effect of Lake Albert on the Nile. Owing to the fact that an increase in the discharge of the Victoria Nile cannot pass down the Albert Nile before the whole area of Lake Albert has risen, the floods of the Victoria Nile are delayed nearly five months in their passage down the Albert Nile; a rise of one metre on Lake Albert meaning an increased cube of 4,500,000,000 cubic metres. If this takes place in one year, it represents an increased discharge of 150 cubic metres per second irrespective of what passes down the channel of Lake Albert."

Here Captain Lyons follows Sir William Garstin; but with all deference to Sir William's opinion, I cannot but think that I am right. I base my decision on plate V., supported by Tables XXIV., XXV., XXVII., and XXVIII. If Captain Lyons was as accustomed as I am to examine all gauges with previously prepared discharge tables, he would write with very much less assurance. The discharge tables XXVII. to XL. represent a twelvemonth's hard work, and are one of the great features of my book. A man needs to be a ripe hydraulic engineer to appreciate these tables.

The next criticism is as follows :—

"In discussing the Bahr el Jebel, or the Albert Nile, as Sir W. Willcocks would prefer to call it, he states that the said region is flooded by the Sobat flood to a depth of 3 metres, which would, indeed, give a vast quantity of water temporarily stored. But if the water-slope between Lake No and the Sobat is considered, it will be found that a rise of about 2 metres in the Sobat will produce the flood slope in the White Nile above it; and in 1903 the Sobat rose in all 3·5 metres, causing thus a rise in the water-level at Lake No of about 1·5 metre, or about 1 metre above its banks, which agrees well with observations made by a survey party in September. If now the slope of the Bahr el Jebel be considered, it will be seen that the flooding due to the Sobat must soon disappear upstream, though its effect will be more pronounced in the Bahr el Ghazal, where the slope is less, and it is probably the main factor in producing there the late maximum in December which Dyé noticed. Sir W. Garstin's sections of the Bahr el Jebel, some of which are reproduced in this book, do not show any such inundation effect."

In Sir William Garstin's 'Report on the Basin of the Upper Nile' (p. 119), there is the following:—

"The average depth of water over these swamps during flood is 2 metres; and in high floods, like that of 1903, is as much as 3 metres."

I have no doubt that Sir William knew what he was writing about, after having four times visited the locality.

W. WILLCOCKS.

Cairo, November 10, 1905.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1905-1906.

First Meeting, November 6, 1905.—The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

ELECTIONS:—*Lieut.-Colonel E. H. Gorges, D.S.O. (1st Batt. K. A. Rifles); Colonel R. C. Hellard, R.E.; Captain Frederick William Kershaw, R.N.R.; Leonard W. King; John Leckie; Joseph W. J. Lee; Allan C. Parsons; Captain Arthur Hart Synnot, D.S.O. (East Surrey Regt.); Rev. J. Anderson Watt; Arthur Hamilton Welburn.*

RECENT DEATHS.

In opening the session of 1905-6, the President remarked on the exceptional losses that geography and the Society had sustained through death during the four months' recess. Foremost was that of Elisée Reclus, one of the greatest geographers that France, or indeed the world, had produced. His colossal work, 'La Geographie Universelle,' stood alone as regards its matter, its method, its manner. It might be that no statue, no memorial, would be raised to the memory of this remarkable man, owing to his extreme political views having divided him so widely from the directing classes of his own country; but he needed no such memorial. He had left behind him in his 'Geographie Universelle' a monument more durable than bronze, and his work would live when the social and political controversies of the nineteenth century had passed into the limbo of bygone generations. Shortly after his death, there passed away a man of a very different type, Baron von Richthofen, the widely and deeply respected President of the Berlin Geographical Society, an office which he had filled with notable usefulness and distinction for many years. His work on China was everywhere recognized as the highest authority on the geology and geography of that country. Of a still more different type from either of the above was M. Savorgnan de Brazza, a Roman by birth, who had entered the French navy, and who, like so many naval officers, British and American as well as French, had become a daring and distinguished explorer. But M. de Brazza's fame rested on a later phase of his life as the practical founder of the French Congo. One incident in his career which he (the President) had never seen recorded, but which M. de Brazza had related to him a few years after it occurred, might be of interest. When M. de Brazza left Paris for Africa, before the commencement of his treaty-making campaign against H. M. Stanley in the basin of the Congo, his real instructions were to proceed to the lower Niger and carry out a similar work there, and it was only just before he left Lisbon that he received telegraphic instructions from Paris to proceed instead to the Congo. As at that time the British company formed to secure Nigeria to Britain was in its infancy, and enjoyed no support, but a good deal of obstruction, from the British Government, it could not then have resisted a strong national movement from France, and if M. de Brazza's original instructions had been adhered to, the history of a large section of tropical Africa would have been altered. M. de Brazza's undying claim to memory as a geographer is based on the great number of valuable expeditions carried out in the French Congo and neighbouring regions during his administration of that colony.

The President finally dwelt at some length on the serious losses which the Society has sustained by the death of distinguished British geographers, all of whom had served on the Council. He referred to the valuable services rendered to geography by the late Admiral Sir William Wharton, perhaps most widely known as Hydrographer to the Admiralty for twenty years, and by the late General Sir Charles Wilson, who served for four years with conspicuous ability on the North American Boundary Commission, but whose name will always be associated with the surveys in Jerusalem and Palestine. Dr. Blanford, who died in July last, had rendered eminent services to the more scientific side of geography, as director of the Geographical Survey of India, and as a member of the expeditions in Persia and in Abyssinia. Last of all there was Sir John Farquharson, Sir Charles Wilson's successor as director of the Ordnance Survey, who did so much to improve and extend the maps issued by that department. All of these distinguished officers had filled for many years the offices of vice-presidents and councillors of the Royal Geographical Society, to whose Fellows their memories were endeared by their personal qualities no less than by their great services to geographical science.

The paper read was:—

"Travels in the Mountains of Central Japan." By the Rev. Walter Weston, M.A.

RESEARCH DEPARTMENT.

November 13, 1905.—Sir THOMAS H. HOLDICH, K.C.M.G., K.C.I.E., C.B., in the Chair.

On "The Next Great Arctic Discovery." By Sir Clements Markham, K.C.B.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. *Jb. Schweiz. Alpenclub* **40** (1904–1905): 248–286. **Wäber.**
Walliser Berg- und Passnamen vor dem XIX. Jahrhundert. Von A. Wäber. *With Maps and Illustration.*

Austria-Hungary. **Baedeker.**
Austria-Hungary, including Dalmatia and Bosnia. Handbook for travellers, by K. Baedeker. Tenth Edition. Leipzig: K. Baedeker; London: Dulau & Co. 1905. Size 6½ × 4½, pp. xviii. and 468. *Maps and Plans. Price 8m. Presented by the Publisher.*

Austria-Hungary. *G.Z.* 11 (1905): 18–38, 99–114, 193–217. **Schlüter.**
Das österreichisch-ungarische Okkupationsgebiet und sein Küstenland. Eine geographische Skizze. Von Dr. O. Schlüter. *With Illustrations.*

France—Botany. *B.S. Languedoc. G.* **28** (1905): 5–14. **Blanc and Hardy.**
La Cartographie botanique détaillée sur les environs de Montpellier pris comme exemple. Par L. Blanc et M. Hardy.

France—Communications. *C.R. Congrès S. françaises G.* **24** (1904); 126–146. **Franconie.**
Les Voies navigables en France. Par M. J. Franconie.

France—Côte-d'Or. *C. R.* **141** (1905): 227–229. **Martel.**
Sur une nouvelle exploration du gouffre du Trou-de-Souci (Côte-d'Or). Note de E. A. Martel.

France—Garonne. *C.R. Congrès. S. françaises G.* **24** (1904): 209–221. **Guénot.**
La Navigation de la Garonne dans les temps anciens. Par M. Guénot.

France—Normandy. *C.R. Congrès S. françaises G.* **24** (1904): 375–460. **Turquan.**
Géographie agricole, industrielle, commerciale et économique de la Seine-Inférieure, et plus particulièrement de l'arrondissement de Rouen. Par M. Turquan. *Maps.*

France—North-West Coast. **Lemoine.**
C.R. Congrès S. françaises G. **24** (1904): 261–270.
La Marche des courants de marée autour de la presqu'île du Cotentin. Par M. G. Lemoine. *Charts.*

France—North-West Coast. *C.R. Congrès S. françaises G.* **24** (1904): 270–275. **Parquier.**
De l'invasion de la mer sur les côtes du Cotentin. Par M. Le Parquier.

France—Roman Roads. *C.R. Congrès S. françaises G.* **24** (1904): 486–493. **Blarquez.**
Rapport sur les voies romaines de la France. Par A. Blarquez.

France—South Coast. *Globus* **87** (1905): 149–151. **Engell.**
Eine Dünenerscheinung an der provenzalischen Steilküste. Von Dr. M. C. Engell. *With Map and Illustrations.*

Germany. *IX. Jahresb. G. Ges. Greifswald*, 1903–1905 (1905): 27–110. **Klose.**
Die alten Stromtäler Vorpommerns, ihre Entstehung, ursprüngliche Gestalt und hydrographische Entwickelung im Zusammenhange mit der Litorinasenkung. Von H. Klose. *With Map and Plates.*

Germany—Berlin. **Baedeker.**
Berlin and its Environs. Handbook for Travellers by K. Baedeker. 2nd Edition. Leipsic: K. Baedeker, 1905. Size 6½ × 4½, pp. x. and 248. *Maps and Plans. Price 3m. Presented by the Publisher.*

Germany—Fisheries. **Oliver.**
German Sea-fishing Industry and Trade. Foreign Office, Miscellaneous, No. 636, 1905. Size 10 × 6½, pp. 20. *Price 1½d.*

Germany—Oder. *IX. Jahresb. G. Ges. Greifswald*, 1903–1905 (1905): 201–213. **Deecke.**
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Germany—Pomerania. **Deecke.**
IX. Jahresb. G. Ges. Greifswald, 1903-1905 (1905): **170–200.**
Die Beziehungen der vorpommerschen Städte zur Topographie und Geologie ihrer Umgebung. Von W. Deecke. *With Plans.*

Italy—River-navigation. *B.S.G. Italiana* **6** (1905): 536-548. **Baratta and others.**
A proposito della zona delle "Resultive" e dei suoi rapporti con la navigabilità dei fiumi, appunti del M. Baratta, ed osservazioni del dott. C. W. Guastalla e del prof. G. L. Bertolini. *With Maps.*

Northern Europe—Earthquake. **Deecke.**
IX. Jahresb. G. Ges. Griefswald, 1903-1905 (1905): **135–160.**
Das skandinavische Erdbeben vom 23. Oktober 1904 und seine Wirkungen in den südbaltischen Ländern. Von W. Deecke. *With Map.*

Norway—Flora. **Norman.**
Norges Arktiske Flora. I. Speciel Plantetopografi. 2^{den} Del. J. M. Norman. Kristiania: H. Aschehong & Co., 1900. Size 10 × 7, pp. 761-1487. *Presented by the Royal University of Norway.*
A systematic list of plants, with a statement of their localities.

Norway—Names. **Rygh.**
Gamle personnavne i Norske stedsnavne. Efterladt arbeide af O. Rygh. Kristiana: H. Aschehong & Co., 1901. Size 10 × 6½, pp. xii. and 358. *Presented by the Royal University of Norway.*

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La dévastation des forêts dans les Pyrénées. Par M. Guénot.

Russia—Murman Coast. **Breitfuss.**
Kurzer Ueberblick neber die Tätigkeit der wissenschaftlichen Murmanexpedition, 1898-1904. Von Dr. L. Breitfuss. (Sonder-Abdruck aus den 'Mitteilungen des Deutschen Seefischerei-Vereins,' No. 7-8, 1905.) Size 10 × 7, pp. 20. *Illustrations.*

Russia—Urals. *Zap. Imp. Russ. G.S. (General G.)* **34**; Part iii. (1905): pp. 392. **Krotov.**
Materials for the Geography of the Urals. Oro-Hydrographical Researches in the Southern Parts of the Central Urals. By P. Krotov. [In Russian.] *Map and Illustrations.*

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Beitrag zur Kenntnis der Höhlen in der Schweiz. Von P. Egli. *With Plan and Illustrations.*

Switzerland—Lake of Lucerne. *Globus* **87** (1905): 156-157. **Halbfass.**
Neuere Untersuchungen am Vierwaldstätter See. Von Prof. Dr. W. Halbfass.

Switzerland—Simplon. *C.R. Congrès. S. françaises G.* **24** (1904): 181-197. **Goegg.**
Le Tunnel du Simplon et les Voies d'accès italiennes. Par M. E. Goegg.

Transylvanian Alps. **Lehmann.**
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Schneeverhältnisse und Gletscherspuren in den Transsylvanischen Alpen. Von F. W. P. Lehmann.

United Kingdom—Meteorology. **Mill.**
British Rainfall, 1904. . . . On the Distribution of Rain over the British Isles during the year 1904. . . . Compiled by Dr. H. R. Mill. London, 1905. Size 8½ × 5½, pp. 88 and 280. *Maps, Diagrams, and Plate. Price 10s. Presented by Dr. H. R. Mill.*
Among the original articles is one on the rainfall of Ben Nevis.

United Kingdom—Meteorology. *Quarterly J.R. Met. S.* **31** (1905): 229-237. **Mill.**
Rate of Fall of Rain at Seathwaite. By Dr. H. R. Mill.

United Kingdom—Norfolk. *Geolog. Mag.* **2** (1905): 397-403. **Bonney and Hill.**
The Chalk Bluffs at Trimingham. By Prof. T. G. Bonney, D.SC., and Rev. E. Hill. *With Illustration.*

United Kingdom—Orkney and Shetland. **Baddeley.**
Thorough Guide Series, Orkney and Shetland, with approaches from Edinburgh, Aberdeen, Thurso, and the Western Highlands. By M. J. B. Baddeley. 5th edition. London: Dulau & Co., 1905. Size 6½ × 4½, pp. viii. and 64. *Maps. Price 1s. 6d. net. Presented by the Publisher.*

United Kingdom—Scotland. **Johnston.**
Place-Names of Scotland. By J. B. Johnston, B.D. 2nd edition. Edinburgh: D. Douglas, 1903. Size 7½ × 5½, pp. cxii. and 308. *Price 6s. net.*

This work, practically the only attempt yet made to deal in a comprehensive way with the place-names of Scotland, has been thoroughly revised in this edition (the first appeared some twelve years previously), many corrections having been made and suggestions adopted.

United Kingdom—Wales. *Quarterly J. Geolog. S.* **61** (1905): 608–640. **Fearnsides.**
On the Geology of Arenig Fawr and Moel Llyfnant. By W. G. Fearnsides. *With Map.*

ASIA.

Eastern Asia. *J.R. Colon. I.* **36** (1905): 509–539. **Ireland.**
The British Empire in the Far East. By A. Ireland.

India. *Scottish G. Mag.* **21** (1905): 457–463. **Morrison.**
Some geographical peculiarities of the Indian Peninsula. By C. Morrison.

India—Himalaya. **Hooker.**
Himalayan Journals: or, Notes of a Naturalist in Bengal, the Sikkim and Nepal Himalayas, the Khasia Mountains, etc. By Sir J. D. Hooker. London: Ward, Lock & Co., 1905. Size 10 × 6, pp. xxxii. and 574. *Maps, Portrait, and Illustrations. Price 6s. Presented by the Publishers.*

A page for page reprint of the "Minerva Library" edition, though on larger and stouter paper. The weight of the book is an objection in its latest form, and many will no doubt consider the cheaper edition preferable.

India—Historical. *J.R. Asiatic S.* (1905): 437–449. **Vost.**
Saketa, Sha-chi, or Pi-so-kia. By Major W. Vost. *With Map.*

On the identification of this ancient town, which lay to the north of the Ganges, between Kanauj and Pataliputra (Patna).

India—Rajputana. *J. of T. Victoria I.* **37** (1905): 70–99. **Hendley.**
The Rajputs and the History of Rajputana. By Colonel T. H. Hendley.

Indo-China. **Lepesqueur.**
Société Académique Indo-Chinoise de France. La France et le Siam. Par Parfait-Charles Lepesqueur. Paris; Rouen: L. Mégard, 1897. Size 9½ × 6½, pp. 90. *Presented by the Author.*

Indo-China—Historical. *J. R. Asiatic S.* (1905): 485–511. **Gerini.**
The Nagarakretagama List of Countries on the Indo-Chinese Mainland (*circâ* 1380 A.D.). By Colonel G. E. Gerini.

Japan—Tea. **[Phipps.]**
Tea Culture in Japan. (F. O., Miscellaneous, No. 637.) Size 9½ × 6, pp. 14. *Price 1d.*

Korea—Quelpart. *B. American G.S.* **37** (1905): 396–408. **Hulbert.**
The Island of Quelpart. By H. B. Hulbert. *With Map.*

Philippine Islands. *P. American Philos. S.* **49** (1905): 7–31. **Metzger.**
The Filipino: his customs and character. By Dr. J. A. Metzger. *Illustrations.*

Philippine Islands. ———
The Fifth Annual Report of the Philippine Commission, 1904. 3 vols. Washington, 1905. Size 9½ × 6, pp. (vol. 1) xvi. and 886, (vol. 2) xiv. and 746, (vol. 3) xvi. and 1080. *Maps, Plates, and Diagrams.*

Russia—Caucasus. *Jb. Schweiz-Alpenclub.* **40** (1904–1905): 193–217. **Fischer.**
Im Kaukasus 1904. Von Dr. A. Fischer. *With Maps and Illustrations.*

Russia—Caucasus. *Contemporary Rev.* **88** (1905): 21–35. **Ular.**
The Revival of Georgia. By A. Ular.

Siam. *A travers le Monde* **11** (1905): 261–262. ———
La nouvelle Frontière Franco-Siamoise. *With Map.*

Cf. note in the September number (p. 331).

Turkey—Arabia. (Devey.)
Trade of the Hejaz for the years 1900–4. Foreign Office, Annual, No. 3483. Size 9½ × 6, pp. 20. *Price 1½d.*

AFRICA.

Cape Colony. ——
Cape of Good Hope. Department of Agriculture. Ninth Annual Report of the Geological Commission. 1904. Cape Town, 1905. Size 10 × 7½, pp. 182. *Maps and Sections.*

Cape Verd Islands. *P. Zoolog. S.* (1905) (1): 170–186. **Crossland.**
The Œcology and Deposits of the Cape Verde Marine Fauna. By C. Crossland. *With Maps and Charts.*

Congo State. **Laurent and Wildeman.**
Etat Indépendant du Congo. Mission. Emile Laurent (1903–1904). Enumération des plantes récoltées par Emile Laurent, avec la collaboration de M. Marcel Laurent, pendant sa dernière Mission au Congo, par E. de Wildeman. Fascicule i. (pp. 1–112, pl. 1–38). Brussels, 1905. Size 11½ × 8. *Presented by the Secretary, Finance Department, Congo Free State.*

Congo State. *Quarterly J. Geolog. S.* 61 (1905): 641–666. **Preumont and Howe.**
Notes on the Geological Aspect of some of the North-Eastern Territories of the Congo Free State. By G. F. J. Preumont; with Petrological Notes, by J. A. Howe. *With Map and Plates.*

Congo State. ——
Notice sur l'Etat Indépendant du Congo, publiée par . . . l'Exposition Universelle et Internationale de Liége. Bruxelles, 1905. Size 11 × 7½, pp. 204. *Illustrations and Map.*

Egypt. **Beadnell.**
Survey Department, Egypt. The Topography and Geology of the Fayum Province of Egypt. By H. J. L. Beadnell. Cairo, 1905. Size 11½ × 9, pp. 102. *Maps and Illustrations. Presented by the Survey Department, Cairo.* [To be reviewed.]

Kamerun. *Deutsch. Kolonialblatt* 16 (1905): 498–503. **Müller.**
Die Manenguba-Expedition.
See note in the Monthly Record, November, p. 557.

Morocco. *B.S.G. Lille* 44 (1905): 123–132. **Segonzac.**
La pénétration économique du Sud Marocain. Extraits d'un Rapport de M. le Marquis de Segonzac, au *Comité du Maroc.*

Morocco. *Questions Dipl.* 20 (1905): 65–73. **Terrier.**
La navigation commerciale au Maroc. Par A. Terrier. *With Map.*

Morocco. *Nineteenth Century* 58 (1905): 235–245. **Weir.**
An Autumn Wandering in Morocco. By T. H. Weir.

Nile—Sudd. *J. Linnean S.* (Botany) 37 (1905): 51–58. **Broun.**
Some Notes on the "Sudd" Formation of the Upper Nile. By A. F. Broun.
Adds somewhat to our knowledge of the conditions and botanical composition of the sudd (cf. note, *ante*, p. 556).

Rhodesia—Archæology. *Rep. South African Association* (1904): 519–525. **Hall.**
Inyanga Fort. A Report of an Examination of these Ruins. By R. N. Hall. *Plan.*

South Africa. *American J. Sc.* 20 (1905): 107–118. **Mellor.**
The Glacial (Dwyka) Conglomerate of South Africa. By E. T. Mellor. *With Illustrations.*

South Africa—Geology. **Corstorphine.**
Rep. South African Association (1904): 145–181.
The History of Stratigraphical Investigation in South Africa. By G. S. Corstorphine. *Table.*

South Africa—Kalahari. **Schönland.**
Rep. South African Association (1904): 308–317.
Biological and Ethnological Observations on a trip to the North-East Kalahari. September, 1903. By Dr. S. Schönland.

Transvaal—Geology. **Kynaston and Hall.**
Rep. South African Association (1904): 182–196.
The Geological Features of the Diamond Pipes of the Pretoria District. By H. Kynaston and A. L. Hall. *Map and Illustrations.*

West Africa. **Blyden.**
West Africa before Europe, and other Addresses, delivered in England in 1901 and 1903. By Dr. E. W. Blyden. With an Introduction by Casely Hayford. London: C. M. Phillips, 1905. Size 7½ × 5, pp. iv. and 158. *Portrait. Price* 3*s.* 6*d. net. Presented by the Author.*

The views here put forward respecting the true methods of dealing with the African problem are evidently the result of earnest thought, and deserve careful consideration by all concerned in its solution.

West Africa. *J. Manchester G.S.* **20** (1904): 97–109. **McDermott.**
The Development of West Africa. By the Rev. P. A. McDermott. *With Illustrations.*

NORTH AMERICA.

Alaska. *B. American G.S.* **37** (1905): 468–479. **Brooks.**
The Alaskan Range: a New Field for the Mountaineer. By A. H. Brooks. *With Map and Illustrations.*

Alaska. *Smithsonian Misc. Coll.* **49** (No. 1584, 1905): pp. 118. **Maddren.**
Smithsonian Exploration in Alaska in 1904, in search of Mammoth and other fossil remains. By A. G. Maddren. *Maps and Illustrations.*

Noticed in the Monthly Record, November, p. 558.

Alaska. *U.S. Geol. Surv., B.* No. **250** (1905): pp. 64. **Martin.**
The Petroleum Fields of the Pacific Coast of Alaska, with an Account of the Behring River Coal Deposits. By G. C. Martin. *Maps and Illustrations.*

Alaska. *U.S. Geol. Surv., B.* No. **236** (1904): pp. 36. **Wright.**
The Porcupine Placer District, Alaska. By C. W. Wright. *Maps and Illustrations.*

Alaska—Minerals. *U.S. Geol. Surv., B.* No. 259 (1905): pp. 196. **Brooks and others.**
Report on Progress of Investigations of Mineral Resources of Alaska in 1904. By A. H. Brooks and others. *Maps.*

Canada—Geological Survey. ——
Summary Report of the Geological Survey Department of Canada for 1904. Ottawa, 1905. Size 9½ × 6½, pp. xxxviii. and 392. *Maps, Plans, etc.*

Canada—Historical. *T.R.S. Canada*, Ser. II. **10** (1904): Sect. 2: 223–238. **Sulte.**
Radisson in the North-West, 1661-63. By B. Sulte.

Canada—New Brunswick. **Bailey.**
T.R.S. Canada., Ser. II. **10** (1904): Sect. 4: 123-138.
The Volcanic Rocks of New Brunswick. By Dr. L. W. Bailey. *Plate.*

Canada—New Brunswick. **Ganong.**
T.R.S. Canada, Ser. II. **10** (1904): Sect. 2: 3-185.
A Monograph of the Origins of Settlements in the Province of New Brunswick. By Dr. W. F. Ganong. *Maps.*

Canada—North-East Coasts. **Low.**
Summ. Rep. Geol. Surv. Dep. Canada (1904): 122–143.
The Government Expedition to Hudson Bay and Northward by the s.s. *Neptune*, 1903–04. Geology and Natural History. By Commander A. P. Low.

A general account of the expedition was given in the September number (pp. 318–320).

Canada—Ontario. *Summ. Rep. Geol. Surv. Dep. Canada* (1904): 225–228. **Hunter.**
Raised Shorelines along the Blue Mountain Escarpment. By A. F. Hunter.

United States—California. *Sierra Club B.* **5** (1905): 287-296. **Badè**
The Tuolumne Cañon. By W. F. Badè. *With Illustrations.*

United States—California. *Sierra Club B.* 5 (1905): 279-286. **Gilbert.**
Systematic Asymmetry of Crest-Lines in the High Sierra of California. By G. K. Gilbert. *With Illustrations.*

United States—Hydrology. ——
U.S. Geol. Surv., Water-Supply Paper, No. 110 (1905): pp. 212.
Contributions to the Hydrology of Eastern United States. 1904. *Map and Illustrations.*

United States—Indian Territory. *U.S. Geol. Surv., B.* No. 248 (1905): pp. 70. **Gannett.**
A Gazetteer of Indian Territory. By H. Gannett.

United States—Montana. *U.S. Geol. Surv., B.* No. 237 (1905): pp. 208. **Pirsson.**
Petrography and Geology of the Igneous Rocks of the Highwood Mountains, Montana. By L. V. Pirsson. *Maps and Plates.*

United States—New York. *U.S. Geol. Surv., B.* No. 242 (1904): pp. 64. **Dale.**
Geology of the Hudson River Valley between the Hoosic and the Kinderhook. By T. N. Dale. *Maps and Illustrations.*

United States—Oregon. *U.S. Geol. Surv., B.* No. 252 (1905): pp. 138. **Russell.**
Preliminary Report on the Geology and Water Resources of Central Oregon. By Israel C. Russell. *Maps and Illustrations.*

United States—Place-names. *U.S. Geol. Surv., B.* No. 258 (1905): pp. 334. **Gannett.**
The Origin of Certain Place-names. (2nd Edition.) By H. Gannett.

United States—Surveys. *U.S. Geol. Surv., B.* No. 245 (1904): pp. 328. **Gannett.**
Results of Primary Triangulation and Primary Traverse, Fiscal Year 1903–04. By S. S. Gannett. *Map.*

United States—Susquehanna. **Hoyt and Anderson.**
U.S. Geol. Surv., Water Supply Paper No. 109 (1905): pp. 216.
Hydrography of the Susquehanna River Drainage Basin. By J. C. Hoyt and R. H. Anderson. *Maps, Diagrams, and Illustrations.*

United States, Washington. **Smith and Calkins.**
U.S. Geol. Surv., B. No. 235 (1904): pp. 104.
A Geological Reconnaissance across the Cascade Range near the Forty-ninth Parallel. By G. O. Smith and F. C. Calkins. *Map and Illustrations.*

CENTRAL AND SOUTH AMERICA.

Argentine Republic. **Río and Achával.**
Geografía de la Provincia de Córdoba. Por M. E. Río y L. Achával. Two vols. Buenos Aires: Compañía Sud-Americana de Billetes de Banco, 1904–5. Size 11 × 7½, pp. (vol. 1) xxx. and 570; (vol. 2). vi. and 670. *Presented by the Publishers.*

Bolivia—Railways. **Benavides.**
Ferrocarriles en Bolivia. Estudio (ó Proyecto) para su construccion. Por E. Benavides. La Paz, 1904. Size 7½ × 4½, pp. 16. *Map. Presented by the Oficina Nacional de Inmigracion, etc., La Paz.*

Brazil—Amazon. **Goncalves.**
The Amazon. Historical, Chorographical, and Statistical Outline up to the year 1903. By Lopes Goncalves. First edition. New York: H. J. Hanf, 1904. [In Portuguese and English.] Size 9½ × 6, pp. (Portuguese) x. and 118; (English) viii. and 112. *Illustrations. Presented by the Consul-General for Brazil.*

Central and South America. *B. American G.S.* 37 (1905): 461-468. **Smith.**
The Economic Importance of the Plateaux in Tropic America. By J. Russell Smith.

Noticed in the Monthly Record, November, p. 560.

Dutch Guiana. *Bijd. Taal-, Land en Volkenk Ned.-Indië* 4 (1905): 465-480. **Coll.**
Toegift tot de "gegevens over land en volk van Suriname." Door C. van Coll. (Met naschrift en Bijlagen. Door G. P. Rouffaer.)

Paraguay. *Rev. Museo La Plata* 12 (1905): 137-203. **Torres.**
La Geografía Física y Esférica del Paraguay y Misiones Guaraníes, por Don F. de Azara. Examen crítico de su edición. Por L. M. Torres. *With Illustrations.*

South America—Lake Titicaca. *B. American G.S.* 37 (1905): 449–460. **Bandelier.**
The Basin of Lake Titicaca. By A. F. Bandelier. *With Map.*

West Indies. *B. Geolog. S. America* 16 (1905): 243-288. **Hill.**
Pelé and the Evolution of the Windward Archipelago. By R. T. Hill. *With Maps and Illustrations.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australasia. **Glover.**
Round the World Geographical Handbooks. II. Australasia. By G. L. Glover. London: T. C. & E. C. Jack, [*not dated*]. Size 7 × 5, pp. 78. *Maps and Illustrations. Price* 6*d. Presented by the Publishers.*

As in others of the series, the treatment of the subject is carried out, on the whole, on suitable lines, but the limits of space necessarily preclude any detailed elaboration.

Australia—Glaciation. **Waller and Maitland.**
Rep. Australasian Association 10 (1904): 613–619.
Report of the Glacial Committee. (Reports from Messrs. G. A. Waller and A. Gibb Maitland.) *Map and Plate.*

New Hebrides. *Rep. Australasian Association* 10 (1904): 213–216. **Mawson.**
Preliminary Note on the Geology of the New Hebrides. By D. Mawson. *Plates and Section.*

New Hebrides. **Rason.**
Report on the Trade of the New Hebrides. By Captain E. Rason. London, 1905. (Cd. 2714). Size 9½ × 6, pp. 12. *Price* 1*d.*

New Zealand—Glaciation. *Rep. Australasian Association* 10 (1904): 189–205. **Andrews.**
Some Interesting Facts concerning the Glaciation of South-Western New Zealand. By E. C. Andrews. *Plates, etc.*

South Australia—Kangaroo Island. **Hallack.**
Kangaroo Island, 'Adelaide's Sanatorium' (comprising a series of articles written for the *Register* and the *Observer*). By E. H. Hallack. Adelaide: W. H. Thomas & Co., 1905. Size 7 × 5, pp. 216. *Map and Illustrations.*

Tasmania. *Rep. Australasian Association* 10 (1904): 348–375. **Legge.**
A Physiographical Account of "The Great Lake," Tasmania. By Colonel W. V. Legge. *Map and Illustrations.*

Tasmania—Geology. *Rep. Australasian Association* 10 (1904): 622–630. [**Waller.**]
Report of Committee for Recording Structural Features, such as important Folds and Faults in Australasia, with a view to studying the Evolution of the Australasian Land Surface. Presents a report by G. A. Waller on the West Coast of Tasmania.

Tasmania—Physiography. **Twelvetrees.**
Rep. Australasian Association 10 (1904): 210–212.
Note on some Axial Lines of Eruption in Tasmania. By W. H. Twelvetrees.

POLAR REGIONS.

Antarctic—Scottish Expedition. **Bruce and others.**
Scottish G. Mag. 21 (1905): 401–440.
Some Results of the Scottish National Antarctic Expedition—(1) Introduction, by W. S. Bruce; (2) Bathymetrical Survey of the South Atlantic Ocean and Weddell Sea, by the same; (3) Deep-Sea Deposits of the South Atlantic Ocean and Weddell Sea, by J. H. H. Pirie, B.SC.; (4) Meteorology, by R. C. Mossmann; (5) Diego Alvarez, or Gough Island, by R. N. R. Brown, B.SC. *With Maps and Illustrations.*

To be noticed in the Monthly Record.

Arctic. **Peary.**
Snowland Folk, the Eskimos, the Bears, the Dogs, the Musk Oxen, and other dwellers in the Frozen North. By R. E. Peary and the Snow Baby. London: Wells Gardner & Co., [*not dated*]. Size 10½ × 8¼, pp. 98. *Illustrations. Price* 6*s. Presented by the Publishers.*

Picturesque sketches of the dwellers in the far north, evidently intended for young people.

Arctic. *Rev. G.* **29** (1905): 181-188. **Isachsen.**
La tribu la plus septentrionale du monde. Par G. Isachsen. *With Map and Illustrations.*

Arctic. *B.G.S. Pacific* 4 (S. 2) (1905): pp. 16. **Lund.**
To the Magnetic North Pole. The Norwegian *Gjöa* Expedition, under the Command of Roald Amundsen. By Hon. H. Lund. *With Map.*

Arctic. *American J. Sc.* **19** (1905): 333-340. **Spencer.**
On the Physiographic Improbability of Land at the North Pole. By Dr. J. W. Spencer. *Map. Also separate copy, presented by the Author.*

Greenland. *G. Tidskrift* **9** (1887-88): 73-75. **Eberlin.**
Sundet, der i gamle Dage skal have gaaet tværs over Nordgrønland. Af P. Eberlin.
On traditions of a channel leading across Greenland from east to west.

MATHEMATICAL GEOGRAPHY.

Tables. **Davis.**
Requisite Tables containing Tables of Logarithms of Numbers (1 to 10,800), Sines, Tangents, and Secants to five places of decimals, and a Special Table of Logarithmic and Natural Haversines. By P. H. L. Davis. London: J. D. Potter, 1905. Size 10 × 7, pp. vi. and 178. *Presented by the Publisher.*

The chief point in which these tables differ from those in common use consists in the adoption of five places of decimals instead of six, the compiler laying stress on the much greater facility of calculation (especially as regards interpolation) so afforded, while the degree of accuracy is quite sufficient for all practical purposes. There are one or two minor modifications, such as the use of distinctive type for natural numbers and logarithms.

Tables. *U.S. Geol. Surv., B.* No. **234** (1904): pp. 312. **Gannett.**
Geographic Tables and Formulas. (2nd Edition.) By S. S. Gannett.

Tables. **Hall.**
Tables and Constants to Four Figures for use in technical, physical, and nautical computation, and adapted to the requirements of Junior Mathematical Students. Compiled by W. Hall. Cambridge: University Press, 1905. Size 9 × 6, pp. x. and 60. *Price 3s. net. Presented by the Publishers.*

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District Delhi, 1905.—Rajputana, 8 miles to an inch. **District Ajmer**, corrected to 1904; district Merwara, corrected to 1902.—United **Provinces, 4 miles** to an inch. District Gonda, additions to 1905; district **Lucknow, additions to** 1904; district Rae-Bareli, additions to 1904; district Sitapur, **additions to 1905.**— Map of portion of Western Tibet explored by Captain C. G. **Rawling and Lieut.** A. J. G. Hargreaves of the Somerset Light Infantry. **Season 1903, 12 miles to an** inch, 1904.—Assam Survey, 1 mile to an inch. Sheets: 80, **part of district Cachar**, Seasons 1894–96, 1904; 128, part of district Lakhimpur, **Seasons 1899–1900, 1905.** —United and Bengal Provinces Survey, 1 mile to an inch. **Sheet 220 (United** Provinces), 84 (Bengal), districts Ballia (United **Provinces) and Saran (Bengal)**, Seasons 1881–83 and 1895–99, 1904.—Bengal Survey, 1 mile to an **inch. 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Agency), and Udaipur (Rajputana Agency), **Season 1874–75**, 1903; 374, parts of States Gwalior, Bhopal, and Kurwai (C.I. **Agency), and** Tonk (Rajputana Agency), Season 1872–73, 1904; 386, parts of **States Gwalior** and Orchha (C.I. Agency), and district Jhansi (U.P. Agra **and Oudh), Seasons** 1856–57, 1859–60, 1888–90, 1904.—Madras Survey, 1 mile to an inch. **Sheet 72**, parts of districts Tumkur and Chitaldrug (Mysore), Season **1878–79, 1903.**— Punjab Survey, 1 mile to an inch. Sheets: 173, 175, part of **district Montgomery** (Bari Doab), Season 1901–03, 1905; 193, part of district Lahore (**Rechna Doab**), Seasons 1880–81, 1905; 210, part of district Lahore (Bari Doab), **Season 1901–03**, 1905; 211, parts of districts Montgomery, Lahore, and **Ferozepore (Bari Doab)**, Seasons 1901–04, 1904; 223 (Second Edition), parts of districts **Lahore, Ferozepore**, and Amritsar (Bari Doab), Season 1902–03, 1905; 252, parts of districts **Jullundur** and Ludhiana, Season 1885–86, 1904; 330, district Kangra (**Kulu Subdivision**) and Simla Hill States, Seasons 1894–95, 1899–1901, 1904.—Sind Survey, **1 mile to** an inch. Sheets: 115 and 116, Khairpur State, Season 1901–02, **1905.—United** Provinces Survey, 1 mile to an inch. Sheets: 81 (Second Edition), **parts of** districts Naini Tal, Bareilly, and Pilibhit, Seasons 1881–83, 1886–90, **1898–1900**, 1904; 114 (Second Edition), parts of district Kheri, Seasons 1892–94, **1897–99**, 1904; 120, districts Hardoi, Lucknow, and Unao, Seasons 1860–63, **1904; 148**, district Bara Banki Bahraich and Gonda, Seasons 1863–69, 1904. **North-Western** Trans-Frontier Survey, 4 miles to an inch. Sheets: 21 S.W. (**Third Edition), part** of Afghanistan, Seasons 1884–85, 1886–96, 1905; 23 N.W. (Fourth Edition), **part of** Baluchistan, Seasons 1883–90, 1891–92, 1904; 427, part of **Afghanistan, Season** 1878–83, 1894–98, 1904. *Presented by H.M. Secretary of State for India, through the India Office.*

Manchuria. **Military Topographical Dept., St. Petersburg.**
Map of a portion of Manchuria, between Tieh-Ling and Harbin, and Northern Manchuria. Scale 1 : 420,000 or 6·3 stat. miles to an inch. 14 sheets. St. Petersburg: Military Topographical Department, 1905. [In Russian.]

Philippines. **National Geographic Society.**
Map of the Philippines, prepared by reduction from the map of the Bureau of Insular Affairs, War Department. Relief compiled from maps of the Corps of Engineers, U.S. Army, and from Spanish surveys. Scale 1 : 2,350,000 or 37·1 stat. miles to an inch. Supplement to the *National Geographic Magazine* for August, 1905. Washington: National Geographical Society, 1905.

Singapore. **Stanford.**
Map of Singapore, showing the principal residences and places of interest. Scale 1 : 12,672 or 5 inches to a stat. mile. London: Edward Stanford, 1905. *Price 8s.*

A good clearly drawn plan showing proposed new docks, and alterations and improvements.

AFRICA.

Africa. **Topographical Section, General Staff.**
Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheets: 107 and 108, Mossamedes; 109, Lialui; 120, Kalahari; 124, Molopo river. London: Topographical Section, General Staff, War Office, 1905. *Price 2s. each sheet. Presented by the Director of Military Operations.*

Africa. **Topographical Section, General Staff.**
Map of Africa. Compiled in the Topographical Section, General Staff, War Office. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheets: (Northern Nigeria) 63-E.; 63-I. London: Topographical Section, General Staff, War Office, 1905. *Price 1s. 6d. each sheet. Presented by the Director of Military Operations.*

Egypt. **Bureau des Etudes.**
Carte des chemins de fer de l'Etat et des compagnies agricoles. Scale 1 : 400,000 or 6·3 stat. miles to an inch. [Cairo.] Bureau des Etudes, 1905.

This map extends from the Nile delta to Assuan, and shows the various railways and railway systems in different colours and symbols. It is boldly drawn, and is perhaps more of a diagram than a map. Insets are given on enlarged scales, showing the railways in the immediate neighbourhood of Cairo and Alexandria.

Gallaland. **Schmidt.**
Die Gallalander nach den neuesten Forschungsreisen gezeichnet von Carl Schmidt. Scale 1 : 1,500,000 or 23·7 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1905, Tafel 17. Gotha: Justus Perthes, 1905. *Presented by the Publisher.*

A good general map of the region from 2° and 6° 40′ N. lat., and from 33° 45′ to 41° 45′ E. long. It shows the present state of our geographical knowledge, and the routes of all important expeditions.

Tunis. **Service Géographique de l'Armée, Paris.**
Carte de la Tunisie. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Sheet x., Nefza. Paris: Service Géographique de l'Armée, [1905]. *Price 1.50 fr. each sheet.*

AMERICA.

America—Central. **Appleton.**
Mapa de America Central. Scale 1 : 1,705,000 or 26·7 stat. miles to an inch. New York: D. Appleton & Co. (A. R. Ohman), 1905.

Bolivia. **Mesa and Villazon.**
Mapa general de Bolivia por Luis Garcia Mesa, Ex-ingeniero del Estado, contiene los conocimientos y modificaciones geográficas del dia y está conforme con los documentos oficiales del Ministerio de Relaciones Exteriores estudiados con la competente colaboracion del eminente excanciller de dicho ministerio, Exmo. Sr. Dr.

Dn. Eliodoro Villazon, 1° Vice-President, de la Republica. **Scale 1 : 3,200,000 or 50·5 stat. miles to an inch.** La Paz, 1905.

A roughly drawn and poorly printed general map of Bolivia on a small scale. In the absence of anything approaching a proper survey in most parts, it is not surprising, perhaps, that no two maps of the country agree. At the bottom of the map is a vertical section running north-east and south-west from Cochabamba through Lake Poopó. A special feature of the map is that it shows the distribution of natural products in red. It is accompanied by an index.

Brazil—Goyaz. **Santos Azevêdo.**

Carta do Estado de Goyaz. Organizada em 1902 pelo Agrimensor Francisco Ferreira dos Santos Azevêdo. Scale 1 : 2,000,000 or 31·5 stat. miles to an inch. [Goyaz, 1902.] *Presented by Sr. Francisco Ferreira dos Santos Azevêdo.*

Canada. **Surveyor-General of Canada.**

Sectional Map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. The Elbow Sheet (168), west of Third meridian, revised to September 18, 1905; Sullivan Lake Sheet (216), west of Fourth meridian, revised to September 30, 1905; Saskatoon Sheet (218), west of Third meridian, revised to September 18, 1905. Ottawa: Surveyor-General's Office, 1905. *Presented by the Department of the Interior, Canada.*

Canada—Alberta. **Department of the Interior, Canada.**

Map showing the electoral divisions in southern Alberta. Scale 1 : 775,000 or 12·2 stat. miles to an inch. Ottawa: Department of the Interior, 1905. *Presented by James White, Esq., Geographer, Canadian Department of the Interior.*

Canada—Saskatchewan. **Department of the Interior, Canada.**

Map showing the electoral divisions in southern Saskatchewan. Scale 1 : 775,000 or 12·2 stat. miles to an inch. Ottawa: Department of the Interior, 1905. *Presented by James White, Esq., Geographer, Canadian Department of the Interior.*

Peru. **Amadei.**

Mapa geográfico e histórico del Perú, redacto por el Ing. P. Amadei. Scale 1 : 3,000,000 or 47·3 stat. miles to an inch. Lima: "Joya Literaria," [1905].

A general wall-map showing the location of the various Indian tribes, and the international boundaries according to Peruvian claim. Around the border are portraits of eminent men of Peru from the earliest times, with views of the chief towns. The map is highly coloured and varnished.

Trinidad. **Public Works Dept., Trinidad.**

Sketch of Roads in Trinidad. Scale 1 : 221,760 or 3·5 stat. miles to an inch. Trinidad: Crown Lands Office, 1904. *Presented by the Crown Lands Office, Trinidad.*

Main roads, local roads, local-board roads, railways, and unfinished portions of road-scheme roads are all distinguished by different colours.

GENERAL.

British Colonies. **Stanford.**

The Oxford Atlas of the British Colonies. Part i., British Africa. Oxford: William Stanford, [1905]. *Price 2s. 6d. nett. Presented by the Publisher.*

This is the first of a series of cheap popular atlases of the British Colonies in course of preparation by Mr. William Stanford, of Oxford. It consists altogether of seventeen maps, as follows: 1, The World as seen from Cape Town (the somewhat remarkable title given to a hemispherical map with Cape Town in the centre of projection). 2, The World on an Equal Area Projection (Mollweides'), showing British possessions. 3, Rainfall, Atmospheric Pressure, Vegetation and Nationalities of Africa. 4, Temperature Maps. 5 and 6, Physical and Political Maps of Africa. 7 to 10, General Maps of Cape Colony, Natal, Zululand, Transvaal, Orange River Colony, Rhodesia. 11 to 13, British possessions in West, East, and Central Africa. After these follow four outline maps of Africa and South Africa without names, which have been previously published in the 'Autograph Hand Map Series.' Many of the maps are somewhat rough productions, and are evidently intended to give only selected information. The orographical map of Africa would be improved by more attention being paid to the gradation of tints employed. The price is only half a crown.

World. **Meyer.**

Meyer's geographischer Hand-Atlas. Dritte, neubearbeitete und vermehrte Auflage. Leipzig and Vienna: Bibliographischen Instituts, 1905.

A third and revised edition of this atlas. A good index to place-names would be a valuable addition.

World. **St. Martin and Schrader.**

Atlas Universal de Géographie construit d'après les sources originales et les documents les plus récents, avec un texte analytique. Ouvrage commencé par M. Vivien de Saint-Martin, et continué par Fr. Schrader. Sheet No. 66: Afrique Française, Feuille III. (Madagascar). Paris: Hachette et Cie., [1905]. *Price 2 fr. each part. Presented by the Publishers.*

In addition to a general map of Madagascar, this sheet contains, as insets, the central part of the island, a small-scale map of the French Somali coast, and a plan of Réunion. As usual, letterpress stating the authorities connected in its compilation accompanies the sheet.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during July and August, 1905. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3506 m	= 2·5	North sea :—Aussen Jade and Schillig road. 2*s.*
124 m	= 1·4	North sea, Netherlands :—Texel. 1*s.* 6*d.*
3516 m	= 0·7	Norway, west coast :—Nord fiord to Indvik fiord. 2*s.*
3499 m	= 0·7	Sweden, Norrköping bight :—Landsort to Haradskar. 2*s.* 6*d.*
2362 m	= 0·35	Sweden :—Landsort to the Gulf of Bothnia. 2*s.* 6*d.*
3505 m	= 1·4	Baltic sea. Gulf of Bothnia :—Khögklubb to Goskhällan. 2*s.* 6*d.*
33 m	= 1·4	Germany :—Eckernförder Bucht and Kiel fiord. 2*s.*
2714 m	= 2·5	Portugal, west coast :—Port Setubal. 1*s.* 6*d.*
3482 m	= 3·8	Nova Scotia, south-east coast :—Shelburne harbour. 2*s.* 6*d.*
1001		Africa, west coast. Plans on the west coast of Africa. Plan added :—Dakar.
3030		Bays and anchorages on the south coast of Java. New Plan :—Chi Lauteureun bay.

Charts Cancelled.

No.	Cancelled by	No.
124 Texel.	New chart. Texel	124
2362 Landsort to the gulf of Bothnia.	New chart. Landsort to the gulf of Bothnia . . .	2362
33 Kiel fiord.	New chart. Eckernförder Bucht and Kiel fiord . .	33
2714 Port Setubal.	New plan. Port Setubal	2714

(*J. D. Potter, Agent.*)

Charts that have received Important Corrections.

No. 1826, England and Scotland, west coasts :—Formby point to Kirkcudbright. 2676, Scotland, west coast :—Loch Alsh and Loch Duich. 1607, England, east coast :—River Thames, North Foreland to the Nore. 2484, England, east coast :—River Thames, London to Gravesend. 1610, England, east coast :—North

Foreland to Orfordness. 1491, **England, east coast**:—**Harwich harbour.** **1543**, **England, east coast**:—**Yarmouth and Lowestoft roads.** 120, **North sea**:—**River Schelde, from the sea to Antwerp.** 2593, **Germany**:—**Ameland to Jade river.** 3346, **Germany**:—**Jade and Weser rivers.** 2305, **Norway, sheet iii.**:—**Stav fiord to Romsdals islands.** 3101, **Norway**:—**Atleö to Batalden, including the entrance to Stav fiord.** 3118, **Norway**:—**Batalden to Vaagsö.** 1145, **Norway**:—**Vaagsö to Skorpen.** 1146, **Norway**:—**Bövde and adjacent fiords.** 3038, **Norway**:—**Biörnsund to Kristiansund.** 2314, **Norway, sheet xii.**:—**Helgö to Sörö.** 2315, **Norway, sheet xiii.**:—**Sörö to North cape.** 2316, **Norway, sheet xiv.**:—**North cape to Tana fiord.** 2317, **Norway, sheet xv.**:—**Tana fiord to Varanger fiord.** 2252, **Baltic sea**:—**Gulf of Bothnia.** 3503, **Germany, north coast**:—**Gulf of Danzig, western port.** 2835, **Black sea**:—**Delta of the Danube.** 517, **Central America, east coast**:—**Porto Bello and the adjacent coast.** 2544, **South America, east coast**:—**Rio de la Plata.** 1749, **South America, east coast**:—**Monte Video to Buenos Aires.** 1325, **Chile**:—**Gulf of Peñas to the Guaytecas islands.** 650, **Africa, east coast**:—**Plans on the east coast of Africa, Innambán river, Kiliman river.** 1003, **Africa, east coast**:—**Pungwe river, Beira harbour.** 2599, **Red sea**:—**Jidda, with its approaches.** 1419, **Andaman islands**:—**Long island to Port Blair.** 2576, **Borneo**:—**Sulu archipelago and the north-east coast of Borneo.** 3449, **China, east coast**:—**Amoy, outer harbour.** 1798, **China, north coast**:—**Kwang tung peninsula.** 452, **Japan**:—**Yezo island with adjacent straits of Tsugaru, La Perouse, and Yezo.** 2411, **New Zealand**:—**Otago harbour, from the entrance to Dunedin.** 2540, **New Zealand**:—**Awarua or Bluff harbour.**

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for November, 1905. **Washington**: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for November, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Fiji Island. **Pace.**

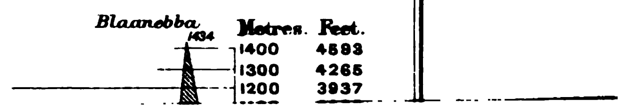
Thirty-one photographs of the Fiji Islands, taken by J. W. Pace, Esq. *Presented by J. W. Pace, Esq.*

An excellent series of platinotypes, carefully described and bound in an album. (1 and 2) Naduruloulou Rewa river; (3 and 4) House-building, Kasavu; (5) A chief's house; (6) Fijian women, Bitiki; (7) Food prepared for presentation to chief; (8) Village group, Kasavu; (9) Bush scene, hill country; (10) A conference, Baitavu; (11) Native bridge; (12) Native implements and weapons; (13) Ratu Join Madraiwiwi, member of Legislature Council of Fiji; (14) Canoes on the Rewa river; (15) Fijian man; (16) Native children; (17) Fijian Vunivola; (18) Native district officer, Naitasiri; (19) Women making pottery, Rewa; (20) District court house, Rewa; (21) Meke Baitavu; (22) Native house wrecked by hurricane; (23) Village scene; (24) Koro Kalobo; (25) Village of Navuso; (26) Chief's house, Island of Ban; (27) Temple, Island of Ban; (28) Island of Munia; (29) Palms, Loma Loma; (30) Tongan church, Loma Loma; (31) Dilo tree, Island of Munia.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

NANSEN
COAST PLATFORM
AND THE
CONTINENTAL SHELF OF NORWAY.

THE GEOGRAPHICAL JOURNAL 1905.



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PRINTED BY WILLIAM CLOWES AND SONS, LIMITED, LONDON AND BECCLES.

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DECEMBER, 1905.

VOL. XXVI. NO. 6.

The Geographical Journal

INCLUDING THE PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

SUMMARY OF CONTENTS.

(For Details, see over.)

PUBLISHED UNDER THE AUTHORITY OF THE COUNCIL.
EDITED BY THE SECRETARY.

LONDON:
THE ROYAL GEOGRAPHICAL SOCIETY, 1, SAVILE ROW;
EDWARD STANFORD, 12, 13 AND 14, LONG ACRE, W.C.

PUBLISHED MONTHLY.] [To Non-Fellows, Price 2s.; 27s. per annum, post free.

For Notices as to the Society's Meetings and other important matter, see p. iv.
Intimation of a change of address must reach the Office of the R.G.S. not later than the 15th of the month.

For List of Council and Officers, Conditions of Admission to the Fellowship of the Society and Society Notices, see pages ii., iv., vi., and viii.

The Geographical Journal.

Authors are alone responsible for their respective statements. In MS. communications all new or unfamiliar geographical names should be written in imitation of Roman type.

CONTENTS.—DECEMBER.

PLATE.

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ROYAL GEOGRAPHICAL SOCIETY.

Candidates for admission into the Society must be proposed and seconded by Fellows, and it is necessary that the description and residence of such Candidates should be clearly stated on their Certificates.

It is provided by Chapter V., § 1, of the Bye-Laws, that—

"Every Fellow shall, on election, be required to pay £5 as entrance fee, and £2 as annual "subscription for the current year, and thereafter a yearly subscription of £2, due on the 1st January "of each year; or he may compound either at entrance by one payment of £35, or at any subsequent "period on the following scale, provided that there shall be at the time no arrears due by him to "the Society:—

Fellows of 10 years' standing and under 15	...	£20
" 15 " " " 20	...	£16
" 20 " " and over	...	£12 10s.

"No Fellow shall be entitled to vote or to enjoy any privilege of the Society while in arrear."

All Subscriptions are payable in advance, on the 1st of January in each year.

The privileges of a Fellow include admission (with one Friend) to all ordinary Meetings of the Society, and the use of the Library and Map-room. Each Fellow is also entitled to receive a copy of all the Society's Periodical Publications.

Copies of the Year Book, Regulations, and Candidates' Certificates may be had on application at the Society's Office, 1, Savile Row, London, W.

ROYAL GEOGRAPHICAL SOCIETY.

NOTICES.*

Meetings in December.—**Monday, December 4.** Exploration in the Abai Basin, Abyssinia. By H. Weld Blundell.—**Monday, December 18.** Exploration in New Guinea (with Cinematograph Illustrations). By C. G. Seligman, M.B., and W. Marsh Strong, M.D.

Research Department.—Meeting in December. Wednesday, December 13, at 5 p.m., in the Map Room.—1. Criticism of the Ordnance Survey Maps from the point of view of the Antiquities on them. By F. J. Haverfield.—2. The Vertical Distribution of Land in England and Wales. By Nora E. MacMunn (introduced by Dr. A. J. Herbertson).—3. Exhibition of some Statistical Maps prepared by Students at the Oxford School of Geography. By Dr. A. J. Herbertson.

The Year Book.—The Year Book for 1905 is now ready, and can be obtained by any Fellow by applying personally or by letter to the Chief Clerk, 1, Savile Row, London, W.

Notice to Fellows in Arrear.—The Council desire to intimate that the Society's publications will not be forwarded to Fellows who are in arrear with their subscription for six months or over.

Any Fellow resident in this country, desiring to have notice of the subjects of papers to be read at the Society's Meetings forwarded to him, can receive such notices by post on payment in advance to the Chief Clerk, at 1, Savile Row, of 2s. per session.

The Society's House will remain open for the Convenience of Fellows on the evenings of the Society's ordinary meetings till 8.15.

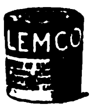
* See also pp. vi., viii. and x.

NOTICE.

PHOTOGRAPHS.

ROYAL GEOGRAPHICAL SOCIETY.

It would greatly add to the value of the Collection of Photographs which has been established in the Map Room of the Royal Geographical Society, if all the Fellows who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they would be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.



NOTICE.

INSTRUCTION FOR INTENDING TRAVELLERS.

Under the authority of the Council of the R.G.S.

Arrangements have been made for the instruction of intending travellers in the following subjects:—

Surveying and Mapping, including the fixing of positions by Astronomical Observations. By Mr. E. A. Reeves, F.R.A.S., Map Curator of the Society.

Geology, including practical training in the field. Under the superintendence of the Director-General of the Geological Survey.

Botany. Under the superintendence of the Director, Royal Gardens, Kew.

Zoology. By Dr. R. Bowdler Sharpe, Natural History Museum, South Kensington.

Anthropological Measurements. Under the superintendence of Dr. J. G. Garson, Anthropological Institute.

Photography. By Mr. John Thomson, Author of 'Photographic Illustrations of China and its People,' and other works.

Meteorology. By Dr. H. R. Mill.

Outfit and Health. Dr. Charles F. Harford, Secretary of the Travellers' Health Bureau.

The lessons are given on days and at hours arranged between the Instructor and the pupil. Tickets for the lessons, at 2*s*. 6*d*. for each hour's lesson, must be previously procured at the Offices of the Society.

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INDEX TO ADVERTISEMENTS.

Where no number is given, the Advertisement does not appear this month.

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